

User Manual for Laser Machine

1. Introduction

介绍

1.1 Safety introduction

安全介绍

The laser machine described here is a Class IV laser device and is dangerous. The laser will instantly ignite clothing, wood, paper, plastics, and many other common items and will Seriously Burn Flesh, Including Eyes. Care must be taken to avoid Serious Injury and/or Blindness. Always operate this and any other high power laser in an environment free of flammable materials, children, pets, spectators, etc. Always use Infrared Eye Protection Goggles when operating this laser.

Failure to do so may result in Permanent Blindness. This laser uses Lethal High Voltages. Care must be taken when working with the high voltage. Failure to do so may result in Serious Injury or Death.

Builder and/or User Assumes All Risks!

By assembling this laser kit, or by using the information contained in this manual to build, repair, or otherwise work with lasers or other high voltage devices of any kind, You Do So At Your Own Risk.

1.2 Fittings prepared

安装准备：

One large water bucket that has a capacity of about 25 kg purity water, using for cooling Laser.

A single stranded copper wire with 2MM diameter, using for grounding.

You will need the following items in order to finish this machine:

An IBM Compatible PC -w-1.6 GHZ or more exclusive Processor. 512 MB RAM OR Greater with one available PCI Slot. Windows XP Operating System Required. *** PS2 Keyboard and Mouse Interface Required *** USB Keyboard is NOT Supported...

1.3 Technical character

技术参数

Laser engraver making use of the high-energy laser beam focus on the surface of the work piece

And gasify the work piece material in order to cut the work piece successfully. And the numeral control worktable can cut the work piece to the designed shape.

The equipment adopt the CO₂ glass laser tube, and use the high-pressure gas discharge to pump the material, the output beam waist of laser reflected to the setting focus mirror of the numeral control worktable. And the numeral control table drive the focus lens move, and according to the designed figure focus the laser on the working material to cutting the work piece.

1) Adopt high grade and exact orbit and bear to make sure the precision and guarantee the long

time and stable production at the same time.

2) Adopt exhaust-fans (风机), air-exhaust pipe, and track exhaust can blow away the exhaust gas efficiently to avoid smoking the lens and cooling machining surface, the down exhaust-fan can blow away the useless gas and have the sorption to the working material. The speed and efficiency system become more faster.

3) High-power guarantee the system work without any disturbance.

4) Laser tube supply adopt the constant current high power switch power supply which can supply to laser continuously.
5) Laser tube can be chosen. The user can choose different power laser tube depends on different requirement. It also can upgrade from low power to high power conveniently

2. Function of Laser engraving machine

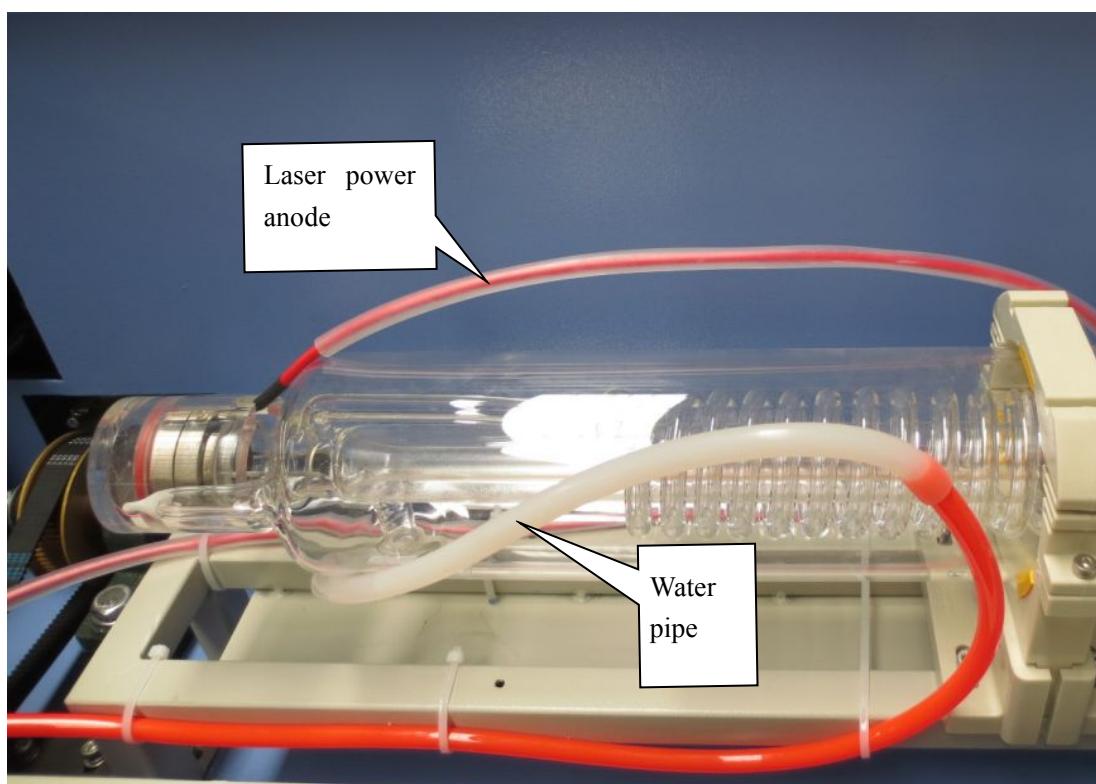
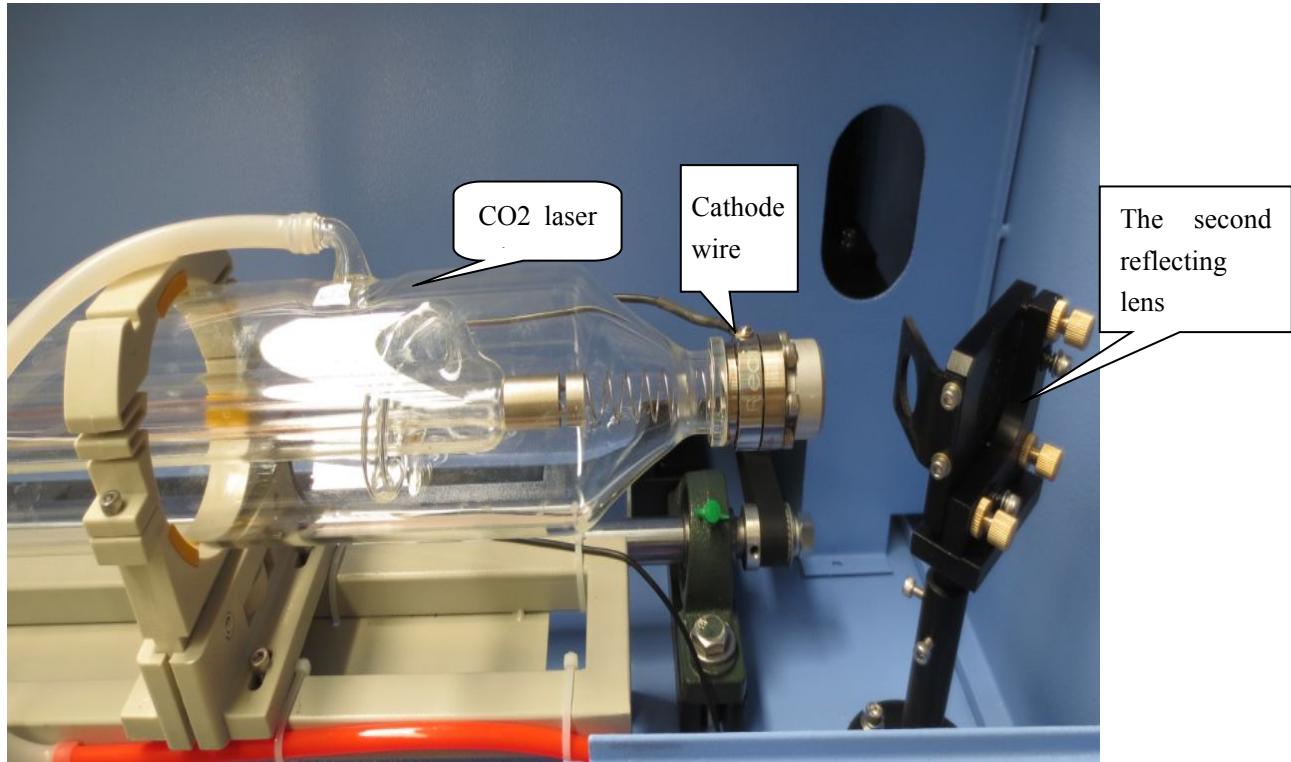
The application scope of laser engraving machine is completely extensive. Different designs have been adapted to our laser machine to meet the needs of all fields. And we believe that the type of machine you've chosen will surely be of great help to your work. The following introductions might provide you some inspirations with choosing and enlarging the scope of usage.

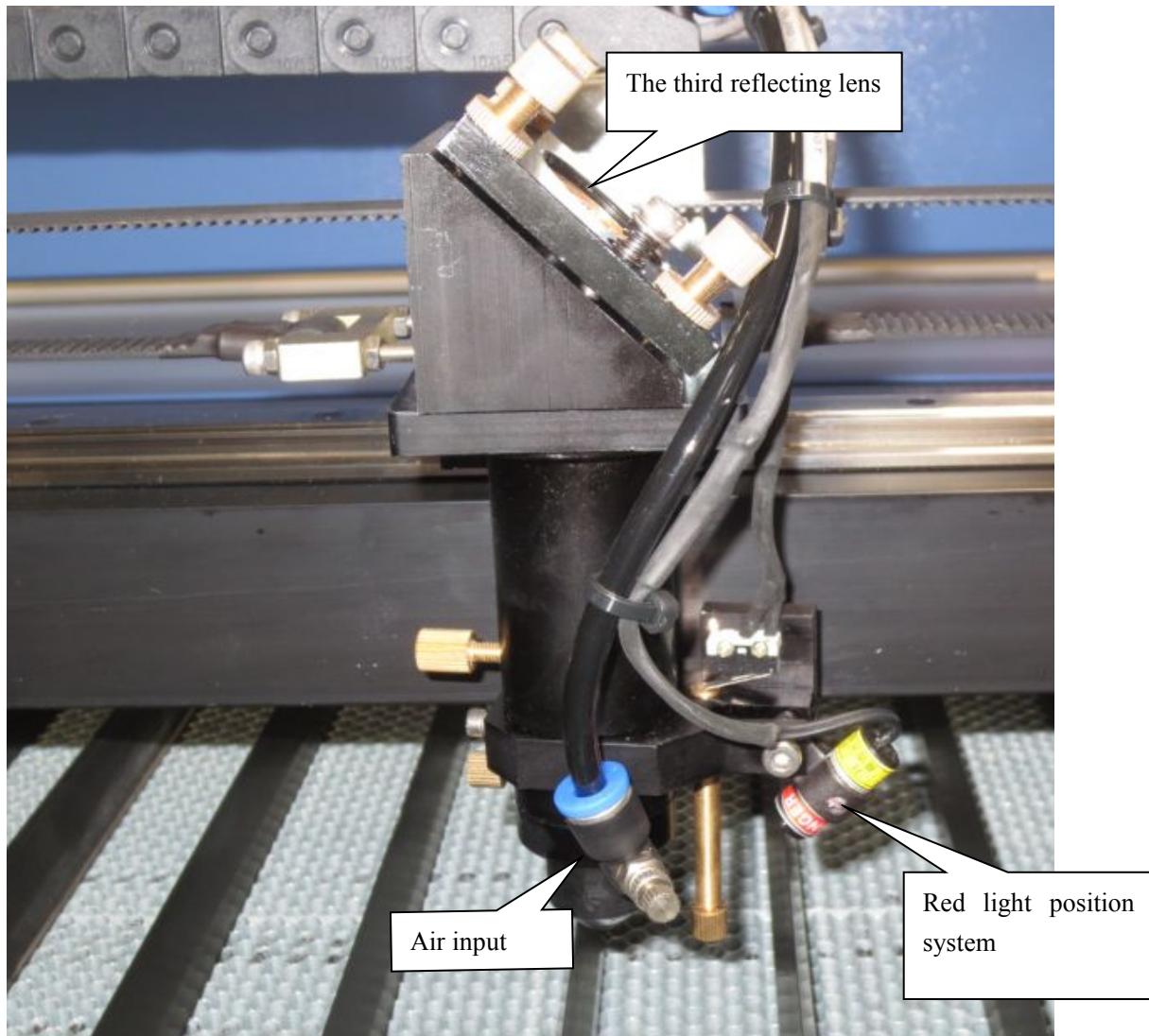
- *.Printing and packaging fields: engraving on rubber plate, laser cutting on paper, etc.
- *.Artwork and gift fields: engraving on bamboo, wooden book, redwood, double-colored plate, box-shaped artwork, chessboard, etc.
- *.Advertising field: engraving (cutting) on organic glass, various tablets and double-colored plate, etc.
- *.Leather and garments fields: cutting on genuine and synthetic leather and different kinds of shoes. And do engraving and cutting on the surface pattern. Cutting on various designs of garment and textiles, etc.
- *.Model fields: engraving (cutting) on architectural model, aviation and navigation models, cartoon figures and sample of industrial model, etc.

3. Structure of main machine

3.1 Sketch map of the main machine

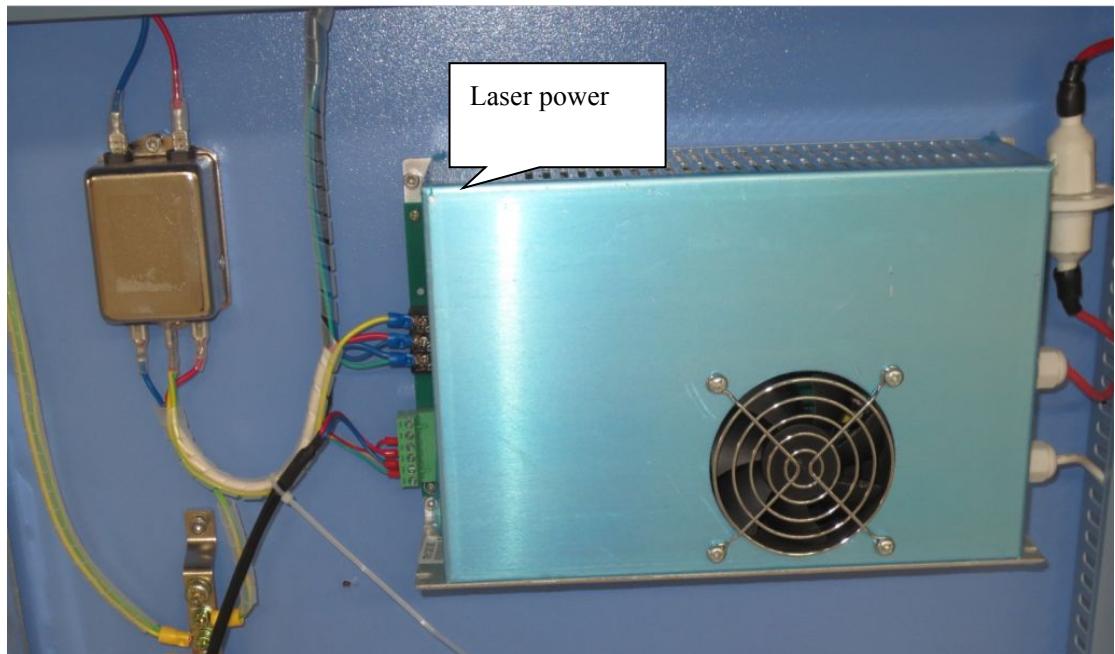


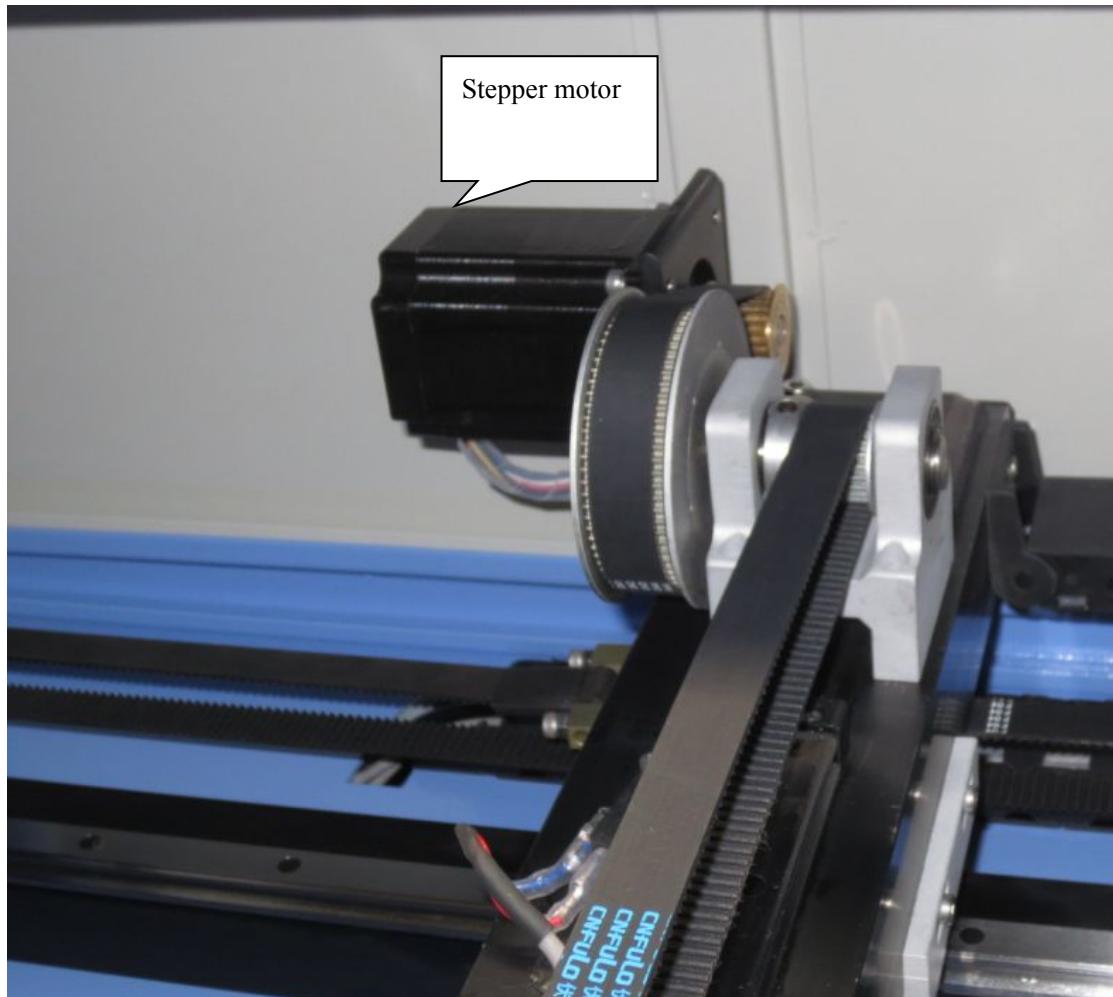






Laser power:激光电源





Function of keys and buttons 按钮功能

Move left Move right Move forward Move backward
Start: Press this button, the machine begins to work..
Edge: Outer frame of the object being engraved
Test: Press this button, the laser tube begins to give out light.
Stop: Press this button when the engraving machine is working, the machine will stop working and return back to the original point.
Reset: Press this button, the laser head will return back to the upper right corner of the machine.
Pause: Make a pause of the working machine. Press the start button, it will start to work again.
The function of the operation panel is the same as computer.
Attention: The operation panel of the machine can work only when the software is open..

4. Installation

4.1 Installation of the main machine

1 Working environment

Attention: Only specialized or trained person is permitted to install and debug the equipment !

1) The equipment working must located in the dry surrounding. If the environment is wet, it will cause abnormal conditions of the equipment .such as Component short circuit , high-voltage part discharge abnormally and so on.

Besides the moisture environment will cause some metal parts rusted.

2) The facility must located in the less-dust room. . Too much dust will pollute the optic parts and reduce the equipment life, and speed up the abrasion of the mechanical parts

3) Working condition :

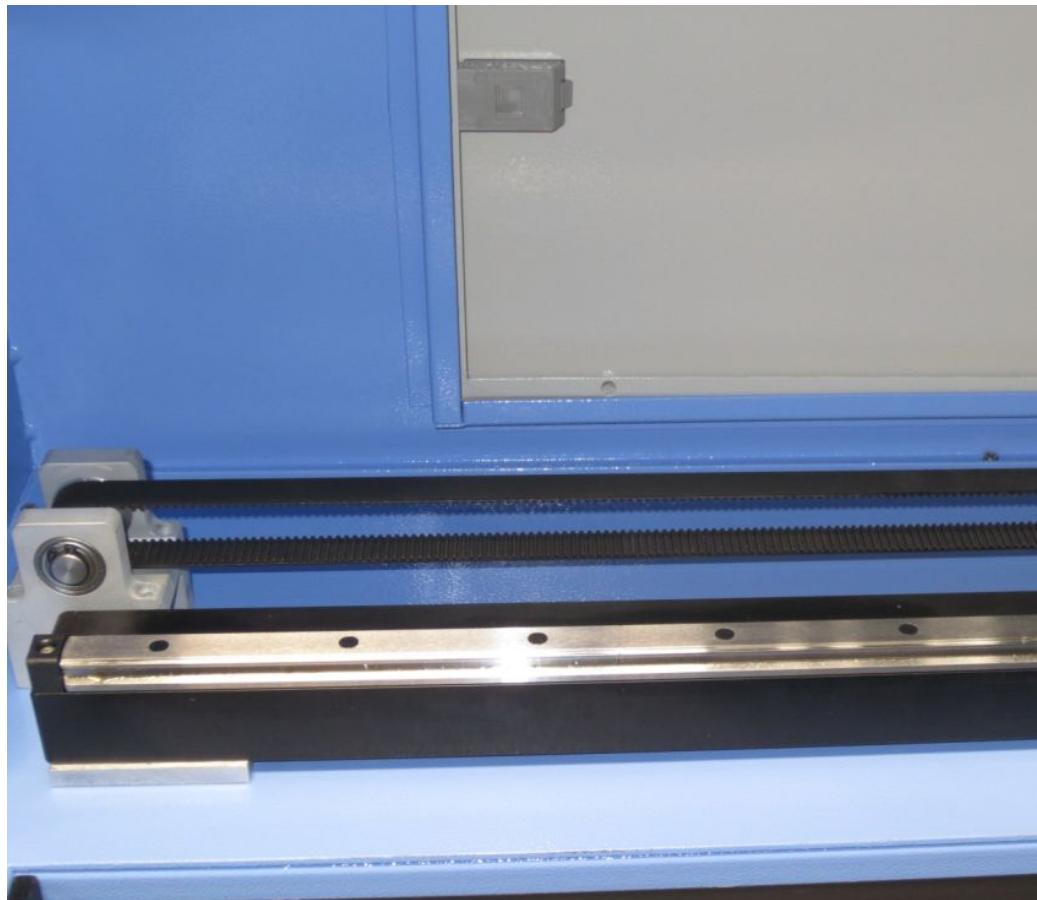
Rounding temperature 10—30°C relative humidity <70%

power supply one phase 110-240V 50Hz 2KW

the fixing should be earthed well and the earthling resistance should less than 4Ω.

2 Disassembly of the package

Open the case to get out the fittings and check them according to the fittings list. Remove the fastness strap.

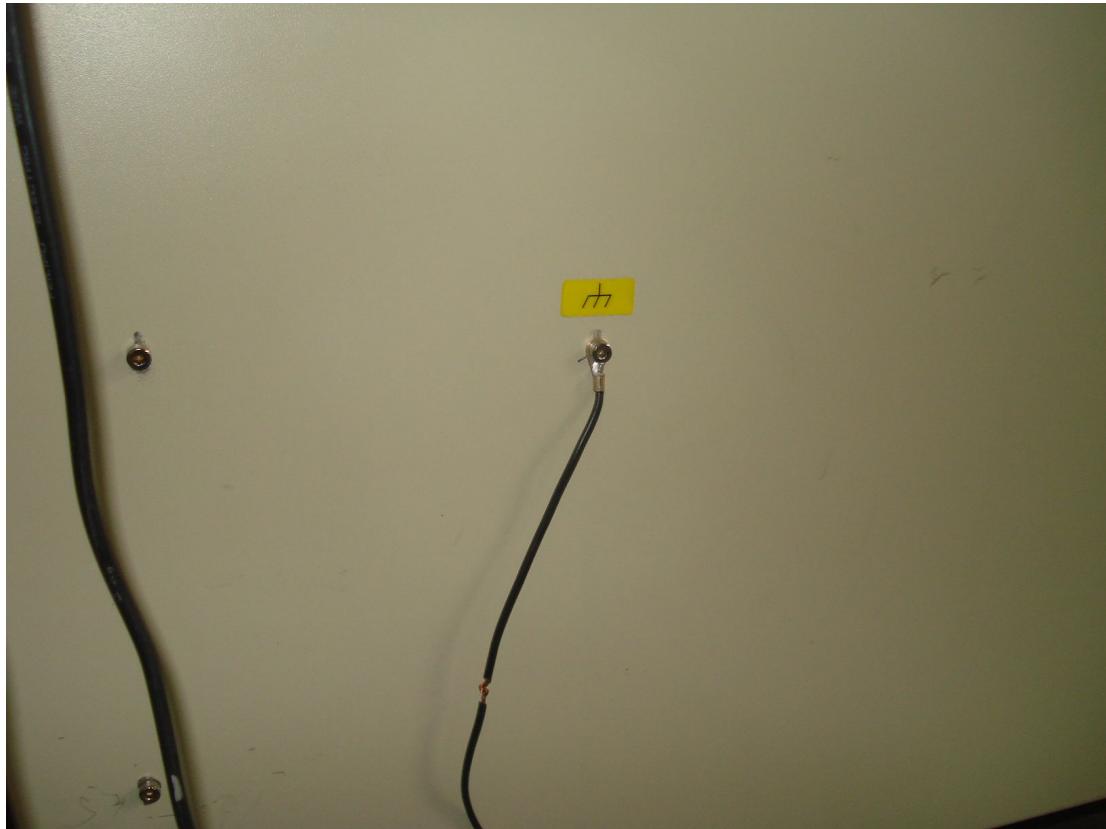


Put down the case from the machine, and check whether there is any damage when it is transported.

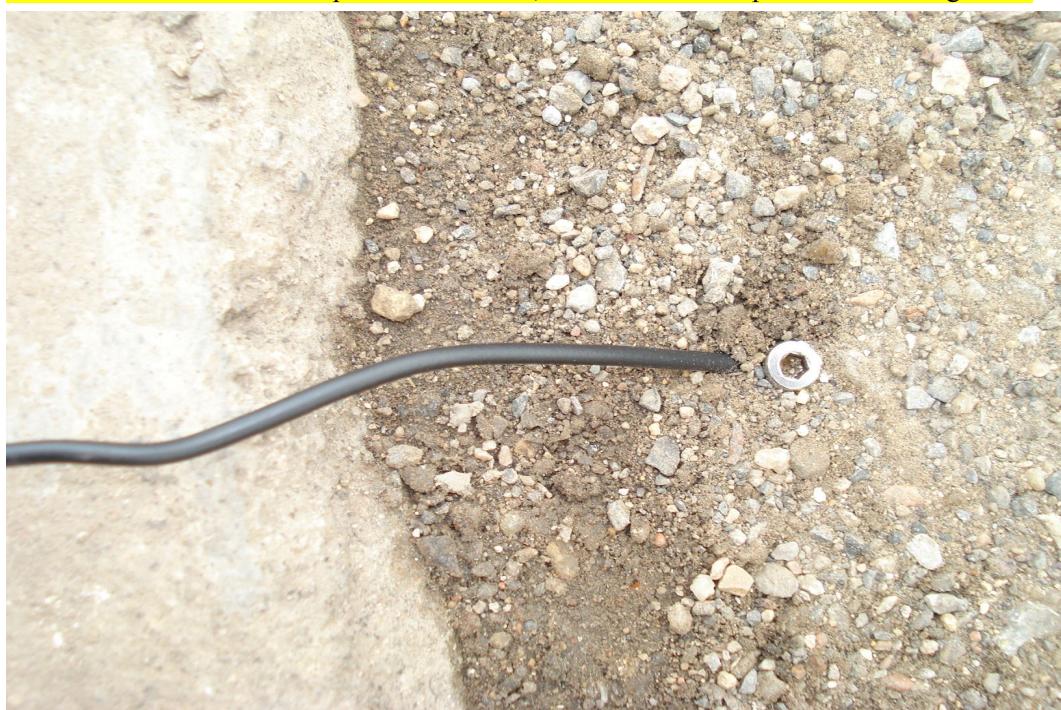
Attention: if you find any damage on the package before open it, or any damage on the machine while installation process, please inform our company or authorized agency.

4Grounding

Find out a single stranded copper wire with more than 2mm diameter.



Fix one side of it to the laser power of the laser, and the other side placed into underground.



5 Connection the general power supply.

Insert power line into the INPUT of the back of the machine



6 Installation of the accessory

1) Installation of the water pump.

Put the water pump into the bucket, then insert the power wire into the main engine. **Connect the water outlet with the water inlet of the machine** and insert the water outlet of the machine into the rubber tube , at last put the rubber tube into the bucket.



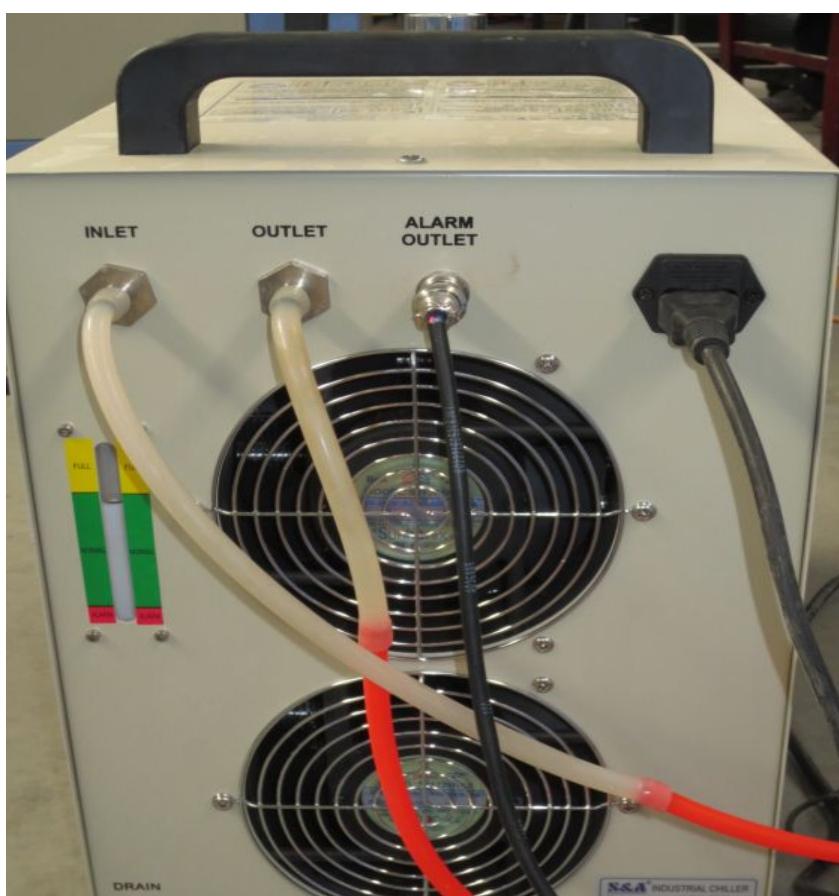
Installation of the chiller (optional feature)

Take down the cover of water inlet on the top of the chiller.



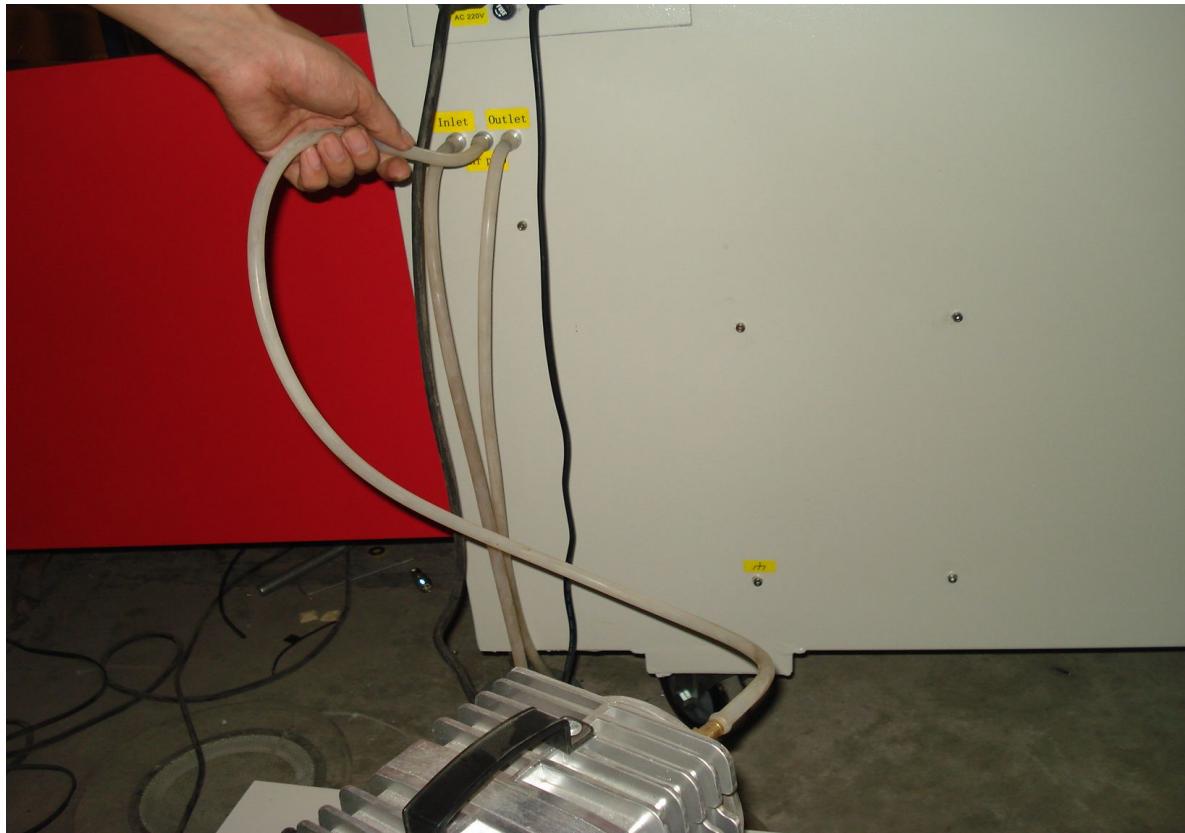
Pour purity water into the water tank until it is full.

Connect the water outlet of the chiller with the water inlet of the machine, and the water inlet of it with the water outlet of the machine.



2) Installation of the air pump

Insert the power line of the air pump into the machine, then connect the rubber tube of gas outlet with the gas inlet of t



3) Installation of the smoke exhaust fan

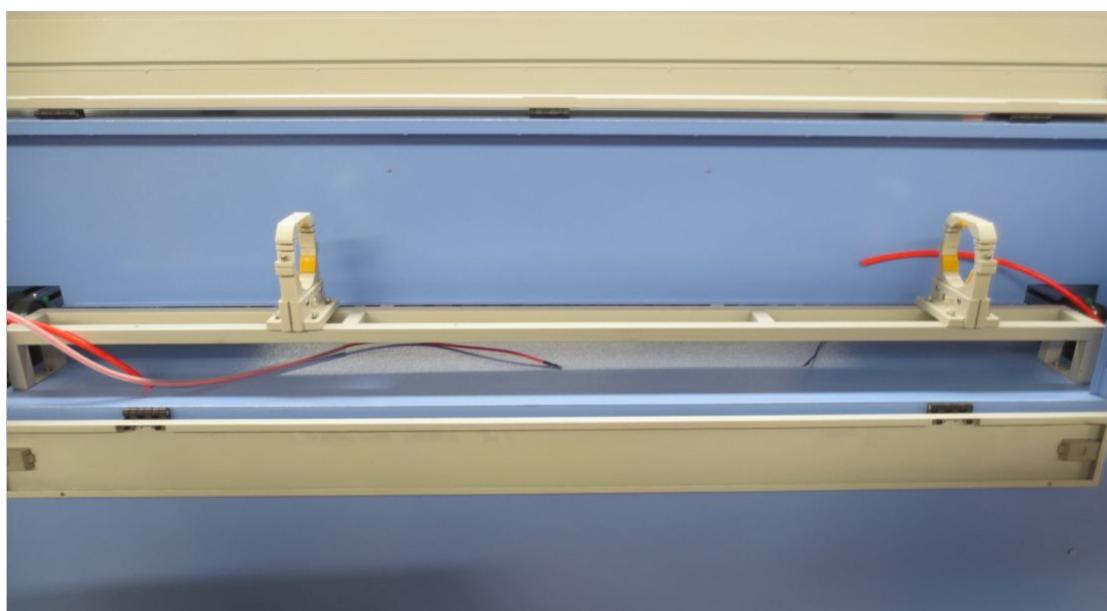
Connect the air inlet of the fan with exhaust port by the blue tube, then plug in the power line of the fan.

Because of the noise of the blower fan, so you'd better put it outside.

7 Installation of the laser tube

Take off the screw from the two mounts which are used for fitting the laser tube.

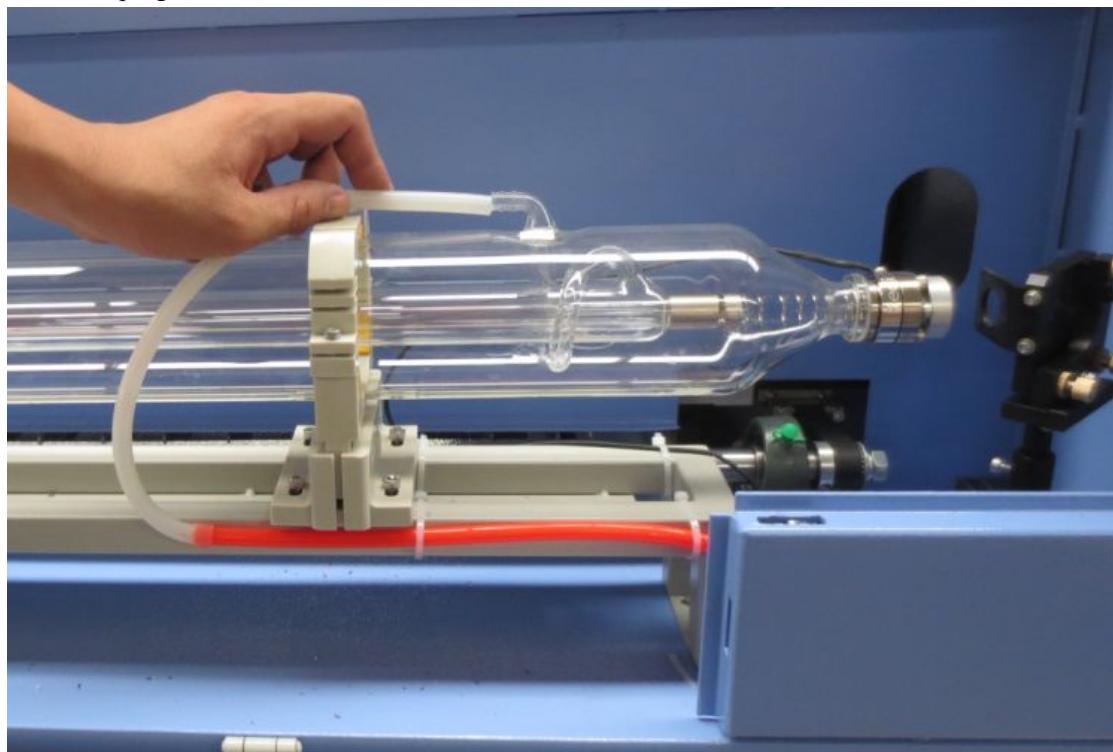
Put the laser tube on two bases.

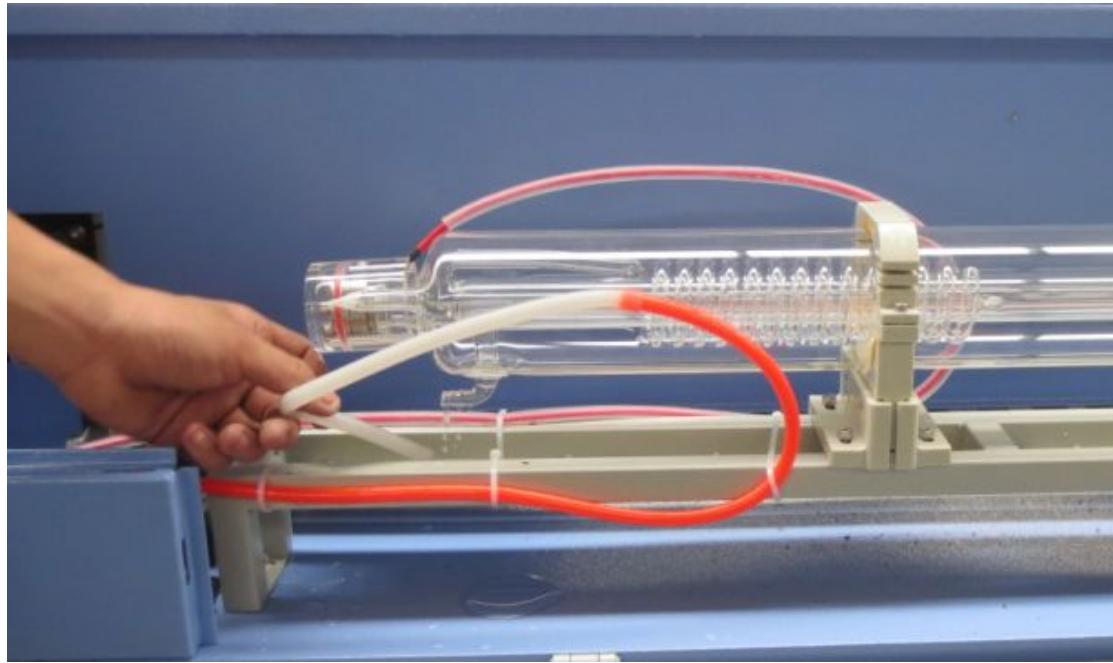




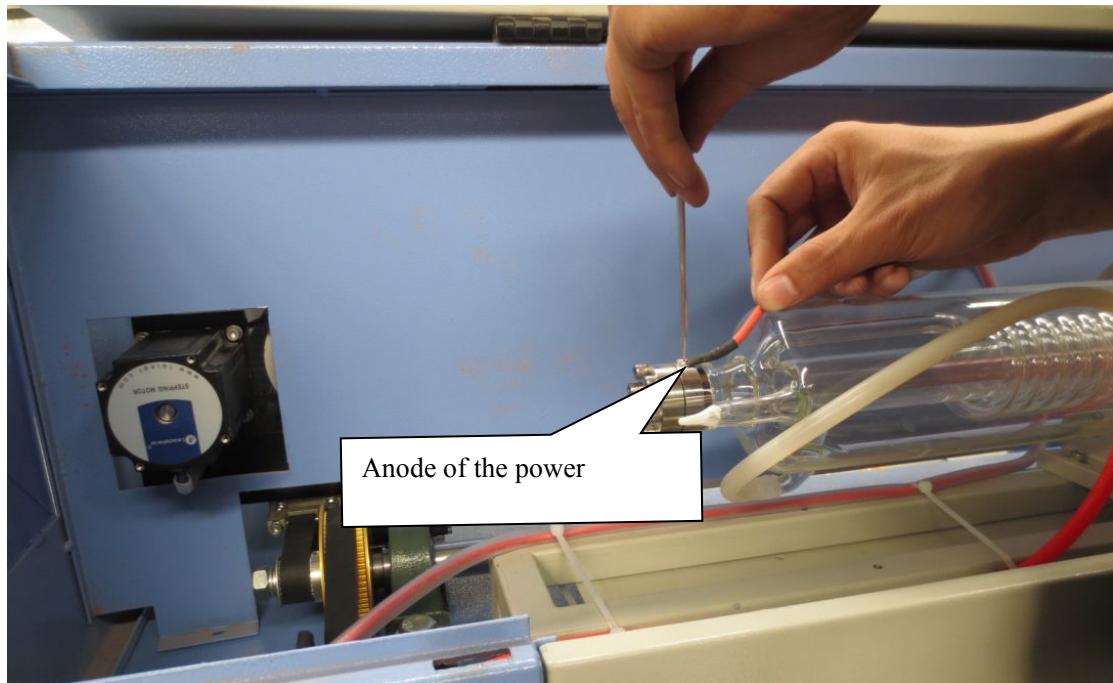
Attention: Light outlet is on the right. Fix the laser tube.

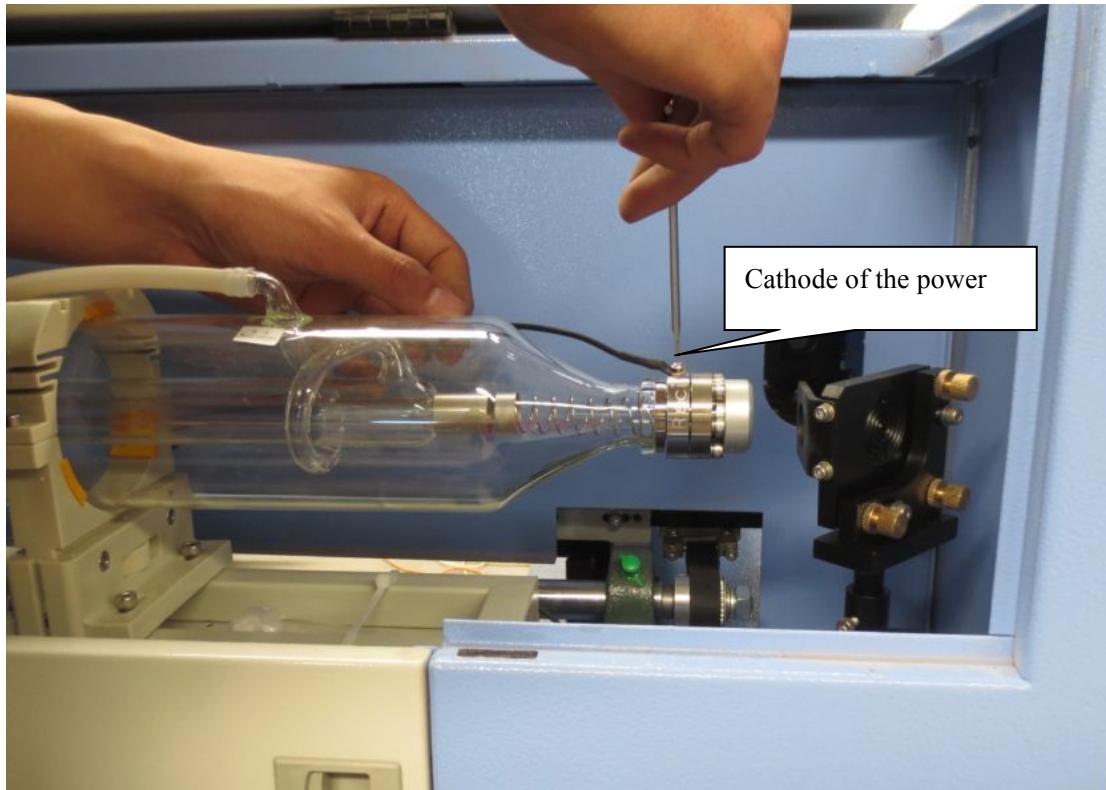
plug in water inlet and outlet.





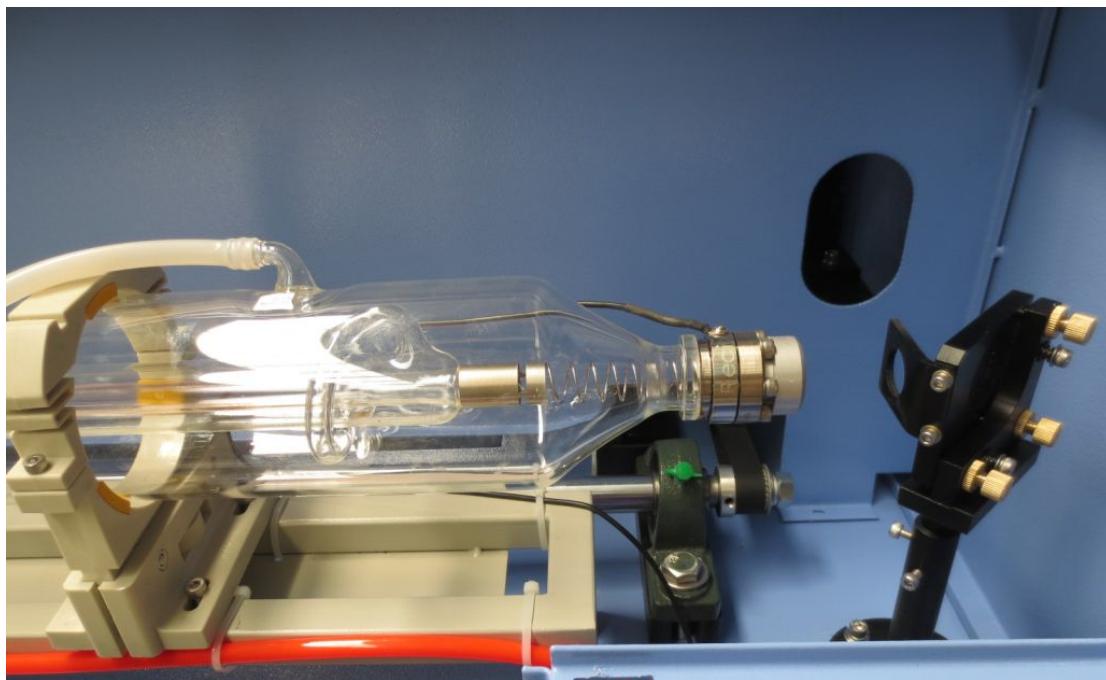
Connect with the anode and cathode of the laser power respectively.





Open the power supply of the machine, then the water pump starts to work. Find out whether there is any bubble of the laser tube after one minute. Revolve the location of the laser tube to squeeze out the bubbles.

Attention: Water inlet of the laser tube should be in the lower place, and water outlet be in the higher, so there won't be any bubble.



8 Installation of the laser power supply

Insert the power line of the laser power supply into control box.



Attention: Do not connect up the power line of the laser power supply before connecting anode and cathode of the Laser tube, otherwise it will burn out the power supply.

9 Detection by boot-strap

Turn on the power supply of the main engine; if you can not move laser head in every direction, it indicates that The dive system of the machine is normal.

Press "test" button, the laser machine works well if the indicator of the ammeter moves.



4.2 Install the software

Attention: You can install the drive only after finding out the hardware

1 Installation of the soft dog

Insert the soft dog into USB faucet, it will notice you that “finding out the new hardware”, running the “DogInst.exe” under the DOG DRIVER, then it will be OK to run Grand Dog Runtimes

4.3 Detection by boot-strap

Open the software, then press every buttons on the surface of the machine to make sure they are running well

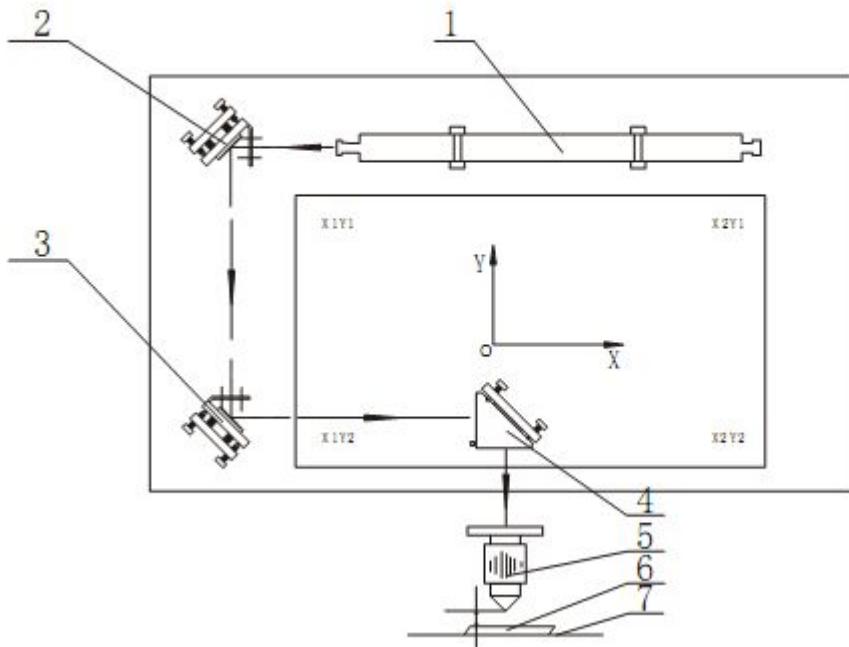
Attention: make sure the cooling water cycle running well before the machine start to work or it will damage the laser tube.

Click “Open the laser” on the software,

Close it to observe whether there is laser

4.4 Adjustment of the optical path

1 The structure chart of optical path



1. Laser tube 2. The first reflecting lens 3. The second reflecting lens

4. The third reflecting lens 5. Focusing lens 6. Object being processed

7. Working platform

Ray path is ray guide system. Laser engraving machine has adopted aviation-optical system.

The complete system is made up of laser tube, three reflecting mirrors, focusing lens and relevant Adjusting devices. These are the main parts of the machine.

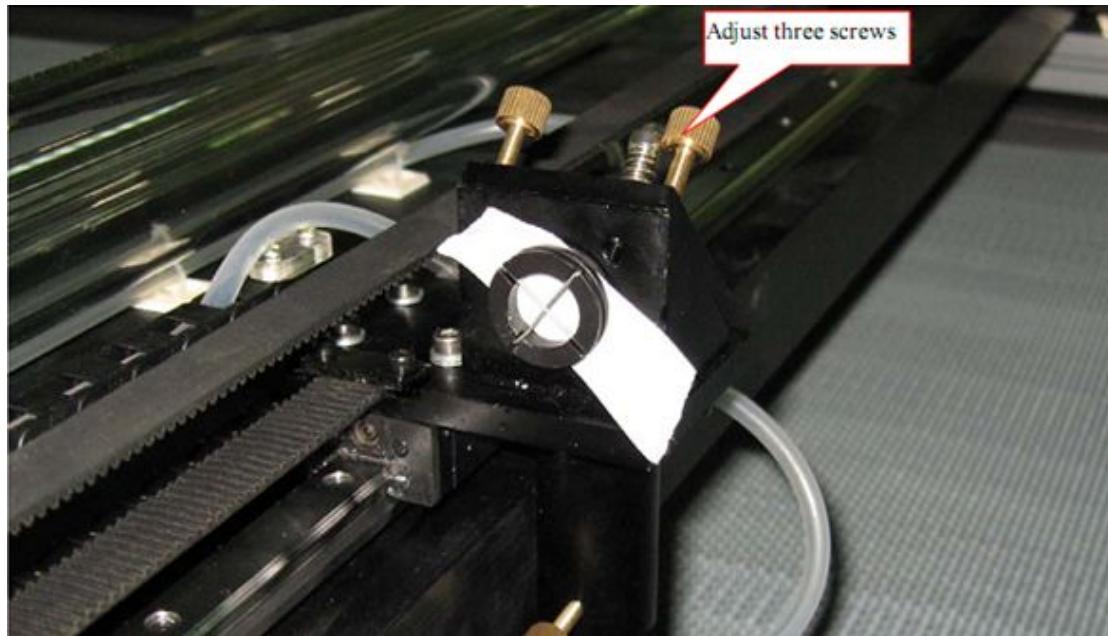
Ray path has close relationship with the effect of engraving and cutting. Therefore please be patient and careful when adjusting the ray path.

Attention: make sure the cooling water cycle running well before the machine start to work, or it will

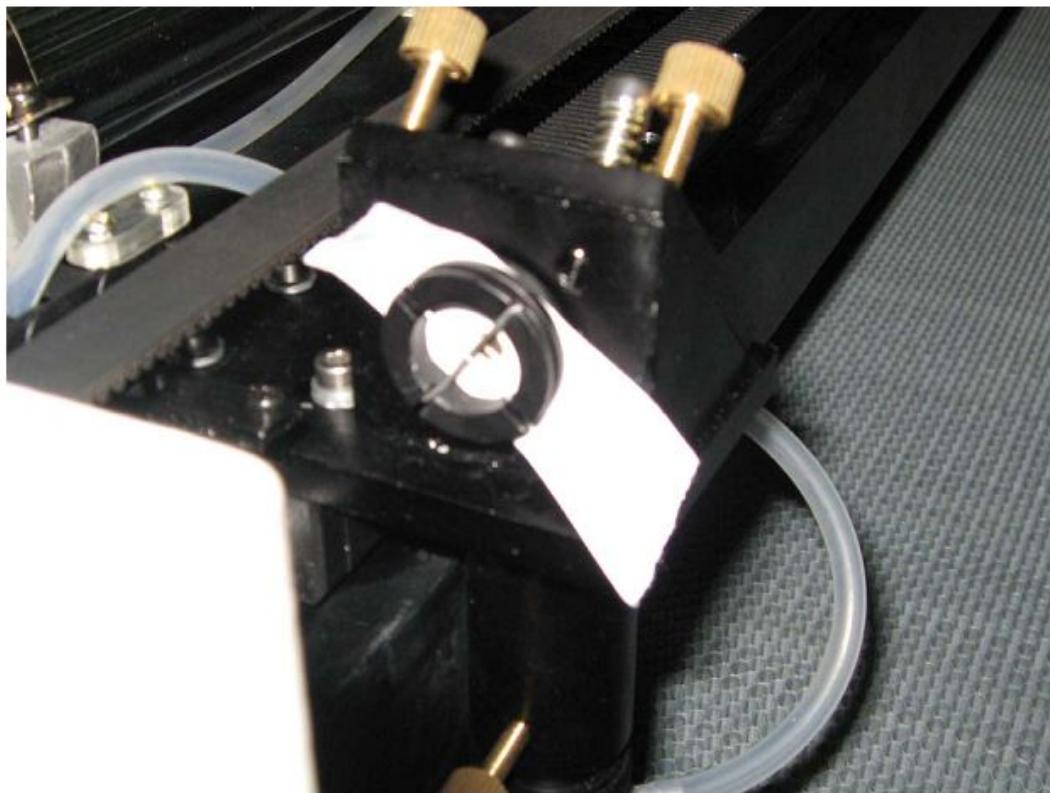
damage the laser tube,

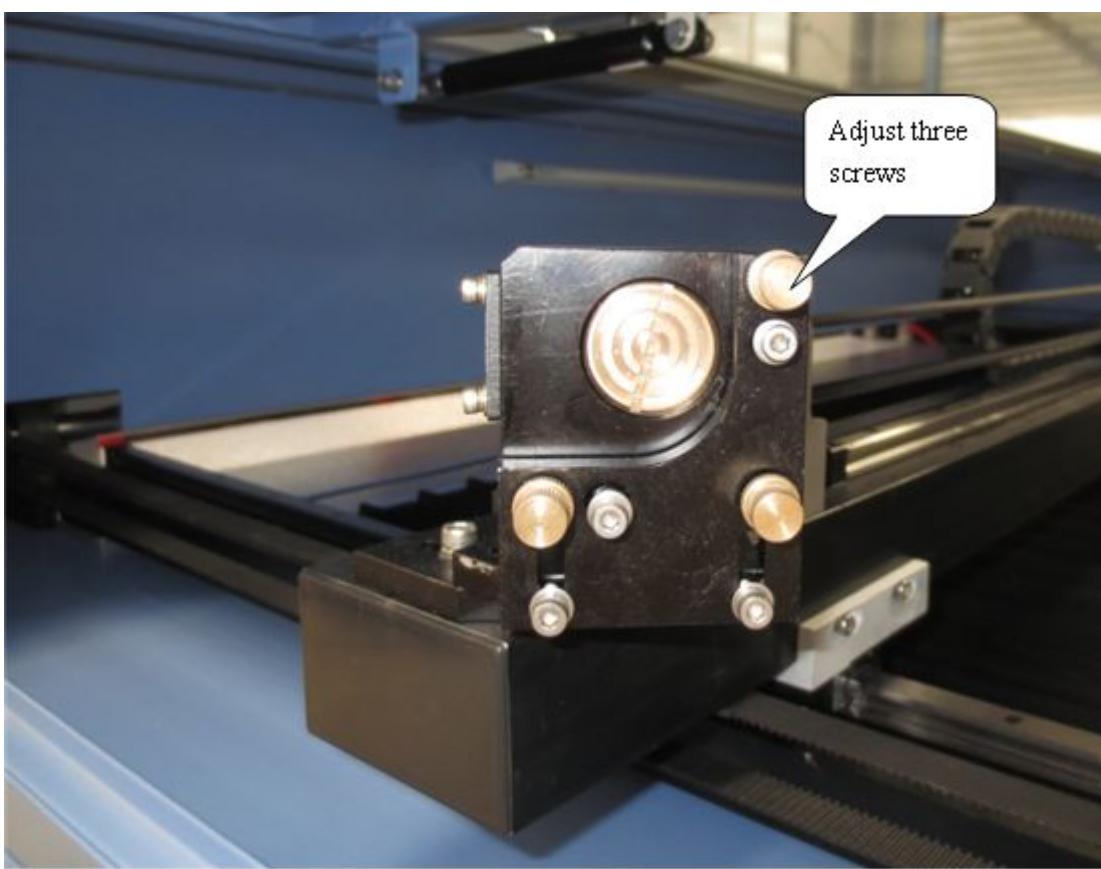
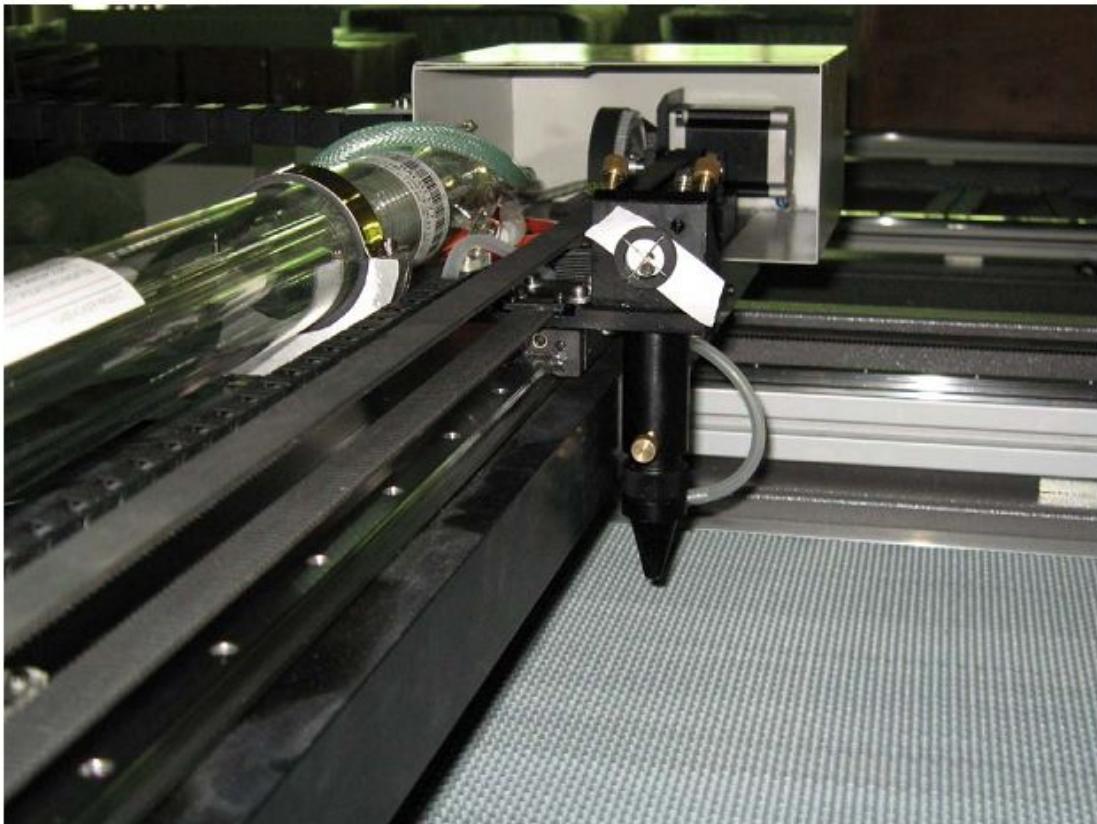
2 Adjustment of the second reflecting lens

Turn to ray path X. Move the laser head to the left of crossbeam. Press “test” button to make a dot



Then move it to the right to make another dot. Using adjusting screw of the second reflecting lens(3) to make these two dots totally matched together.

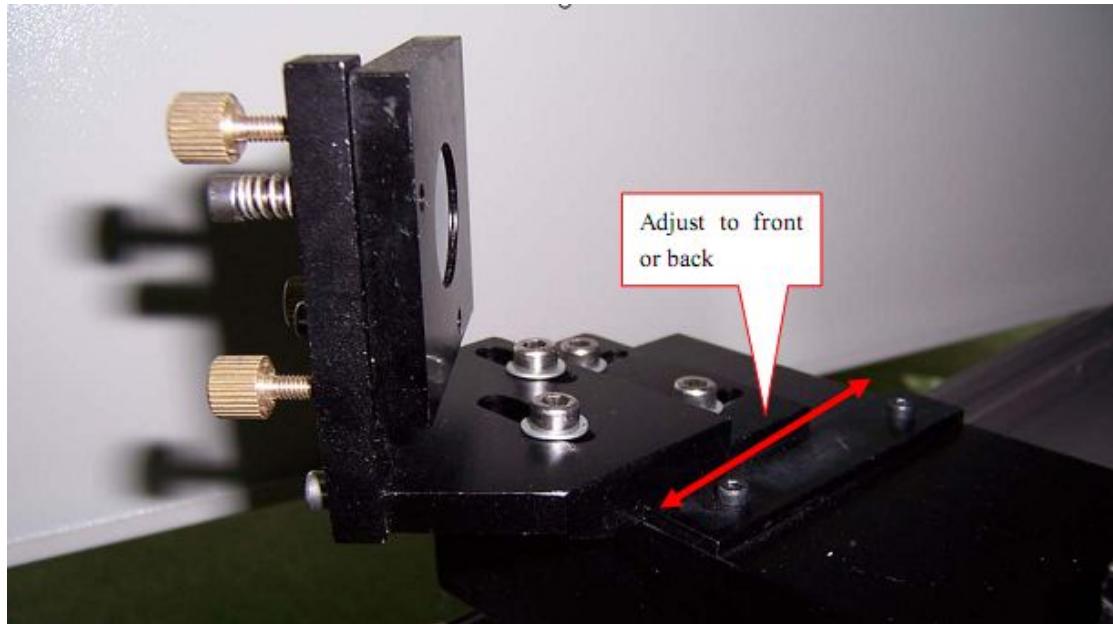




3 Adjustment of the center of laser

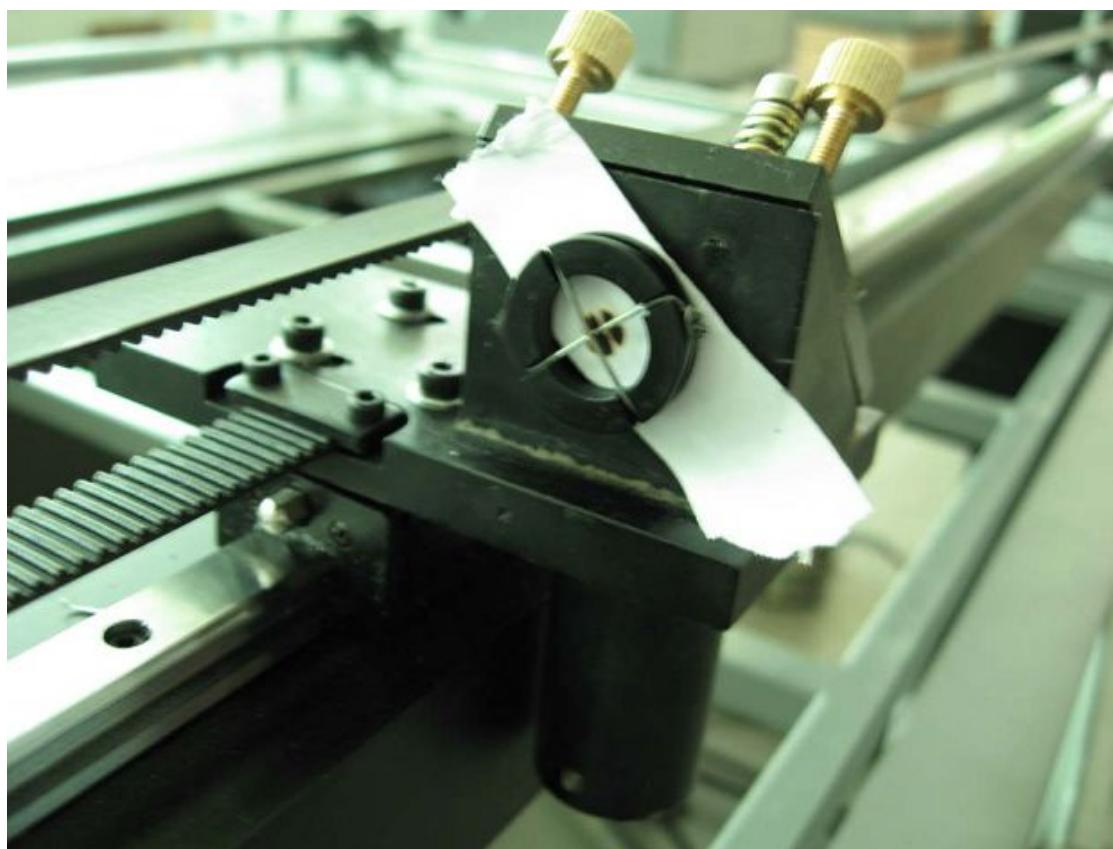
At last, you should make sure that the light was in the center of the indication of the laser center. If it was not in the center, you should adjust the laser tube and the second reflecting lens to the center to make the light to the center part.

Laser tube can adjust the location of the laser up and down. The second reflecting lens mount can adjust the location of laser fore and after.

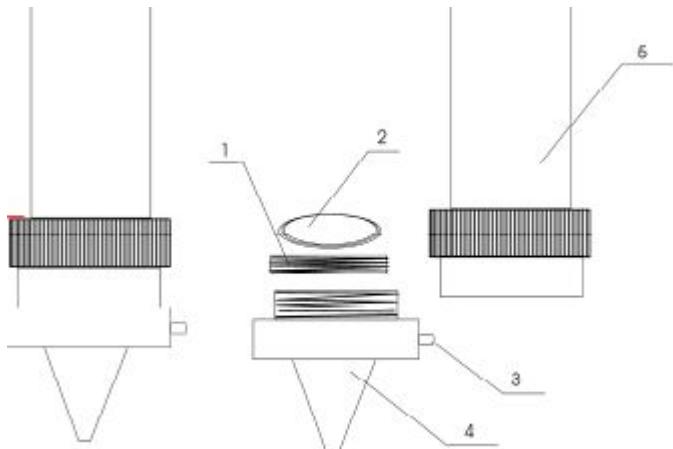


4. Adjust to front or back

If the ray path is adjusted well, the light of the laser head should be in the center of each corner



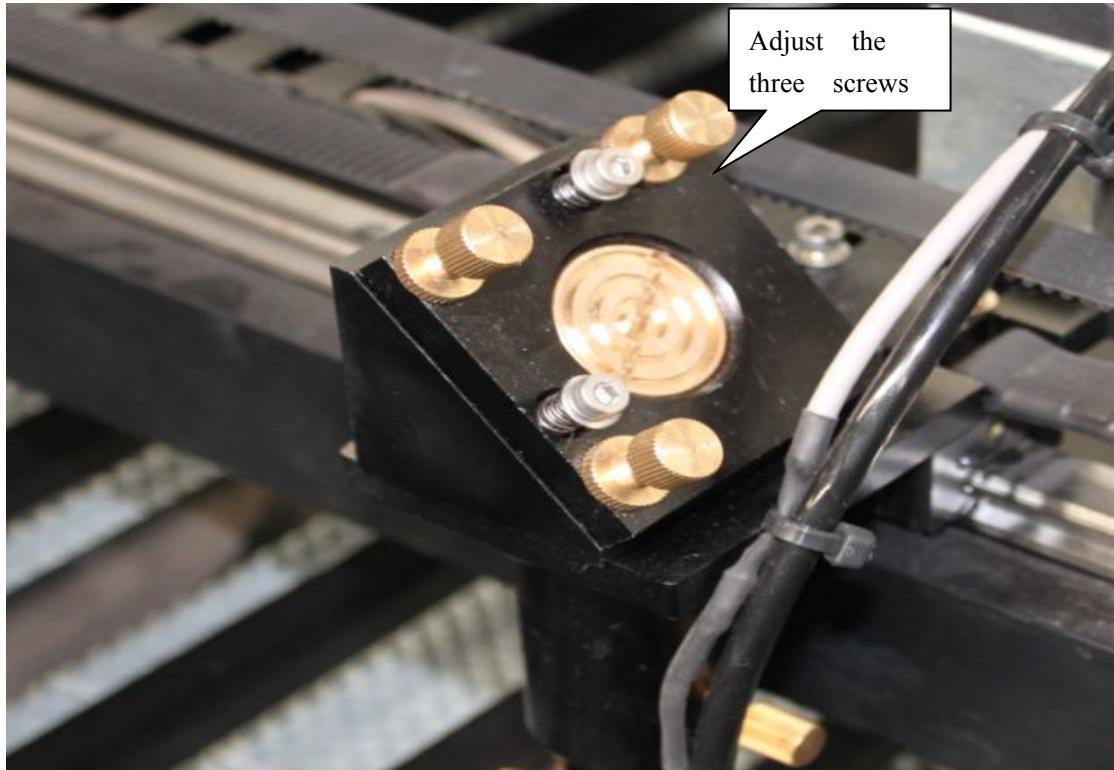
5. Adjustment of the focus lens



Focal length: $55\pm1\text{MM}$ to the surface of object

1. Focusing lens cap	2. Focusing lens (convex side down)	3. Air-in nozzle
4. Air-out nozzle	5. Lens cone	

Put an acryl on the table, loosen the screw which is on the left of the laser head. Move the laser head to 55mm plus-minus 1mm , then press the “test” button on the panel and observe the size of light. The best distance for focus
6 Adjustment of the third reflecting lens



Make sure that whether the acryl is vertical through the spot testing, if not, adjust the third screw upper.
Attention: make sure the cooling water cycle running well before the machine start to work or it will damage the laser tube,

5.Safety consideration and maintenance

5.安全措施和维护

5.1Safety consideration

5.1 安全措施

- 1) It is forbidden to start the machine without grounding. The ground wire of laser power must be connected with the earth. It can not be connected on facilities such as doors, windows, water pipes and so on. The wire should be pulled to the outdoor ground.
- 2) Check the submersible pump to see if it can let the water out each time after starting the machine. It is forbidden to start the machine up when water can not come out from the pump.
- 3) Operators can not leave the machine when it is working in order to avoid unnecessary loss.
- 4) Water container should be a bit larger to make sure that there is 20 kilogram water in circulation. The water temperature should be about 25 C. If the temperature is too high, the water should be changed. It is better to use purified water so that there isn't any contamination. Circulating water should be changed regularly (every three days).

- 5) Because there is laser and high-pressure in the machine, non-professional workers should not disassemble the machine without authorization.
- 6) Reflecting mirror and focusing lens should be wiped with special camera lens paper for medical-use cotton wetted by mixture of alcohol and ether. (Proportion of ether and alcohol should be 1:1) Cleaning of mirrors and lens should be done once a week. It is required that the grounding of all parts of the machine and user's computer should be safe to avoid damage of machine and injuries caused by static electricity.
- 7) Blower fan must be turned on while engraving, so as to avoid pollutions on mirrors and lens. It is forbidden to put any flammable and explosive articles close to the equipment so as to avoid fire.

8) Any irrelevant total reflection or diffuse reflection objects can not be placed in the equipment to prevent the laser from reflecting on human body or flammable articles directly.

9) The water in the laser tube should be drawn off in winter, in order to avoid frost cracking of the tube.

10) When the machine is working , operators should examine the working conditions (such as whether the laser ray has been blocked from shining on the paper used for christenings by the air coming from the air pump, unusual noise, temperature of circulating water, etc.) at any moment.

11) The crossbeam and lorry can not be pulled by hand. The machine should be put in places where there is no interfere and harmful effect of pollution, strong electricity, strong magnetism and so on .

12) When the voltage is not stable, please don't start the machine. It is suggested to use voltage regulator.

13) People who have not been trained should not use the machine.

14) Don't strike the keys and buttons strongly. Please press it lightly to avoid damages of those keys and buttons.

15) In case there is damage or fire, please turn off the power at once.

16) Don't start the machine when there is thunder or lightning. Users should follow all the above mentioned regulations carefully. Otherwise the manufacturer will not take responsibility for any troubles of the machine or physical injuries.

6.2 Maintenance

1. Cooling water

It needs about 25 kilograms of cooling water, the temperature of the water is no higher than 35 °C .Circulating water should use pure water, containing no impurity. It suggested choosing the cooling machine.

2. Laser tube

There should be no bubble in the laser tube, otherwise it will be destroyed. It is suggested that the current should be below 20MA when the laser tube is working. The higher current, the shorter life. It should replace when the laser tube shatter or ending

Warning: the follow step only operated by specialized or trained person. When operate the replacement of laser tube, you should disassembly it. And uninstall should obey follow steps:

- 1) Stop the running machine when disassembly it.
- 2) Let out the cooling water of laser tube.
- 3) Open the back door.
- 4) Pull out out/in water pipe of the laser tube joint, this operation need pull the two side pipe of the tube.
- 5) Take down the anode and cathode of the laser tube.
- 6) Take down the fixed screw.
- 7) Draw out the laser tube form the end of the tube (the faraway of the reflecting lens I) carefully and then put in on the safe place.

Attention: the useless laser tube is fragile and need dealing carefully. Please accord to the rule of how to recycle the glasswork of local law to transact it. And the manufacturer doesn't take any responsibility for the useless glass tube. After uninstall, and setting the new laser tube in term of the following process: Fix the laser tube on the frame in the right direction which means the light outlet towards the first reflecting lens Fix the fasten button..

- 1) Connect with the water inlet and outlet.
- 2) Connect the anode and cathode of the laser tube. Since there is high voltage with the anode, it is better to deal with insulation

3) Turn on the water pump, and cycle the water for one minute. Adjust the location of the laser tube to squeeze out the bubbles

4) Close the door.

5) Starting test.

3 Cleanness of the focus lens

1)The lens will empoinson easily by the dirt and it should clean after use for a period of time. Focusing lens clean Loosen the screw on the left and turn down the lower part. Twist off the gas outlet, then turn down the nut with a flat tool. You will take out the focus lens.

2) Use alcohol to clean the lens until there is not any dirty.

3) Use the alcohol to tidy the laser head and the inner parts to make sure its neatness.

4) Install the focus lens.

Attention: The flat surface of the focus should face up

4. Cleanness of the reflecting lens

Wet the lens tissue with alcohol to wipe it directly.

Attention: You should wipe the reflecting lens entoleted diesel circuit by circuit.

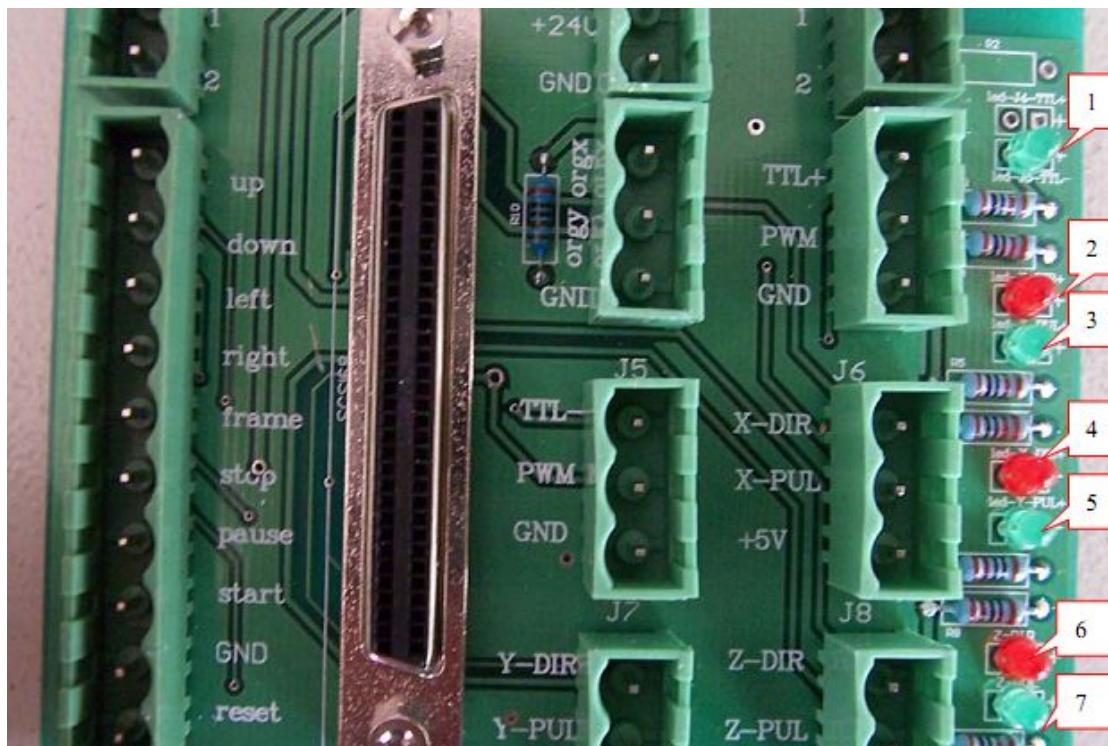
5 cleanliness of Linear guide rail

Clean the filth with clean soft cloth then spread some lubricating fluid.

6. Cleanness of Complete machine

Clean the machine once a week.

7. Familiar malfunction and removal



1. It is not lasing when the lamp is on, otherwise the lamp is off.

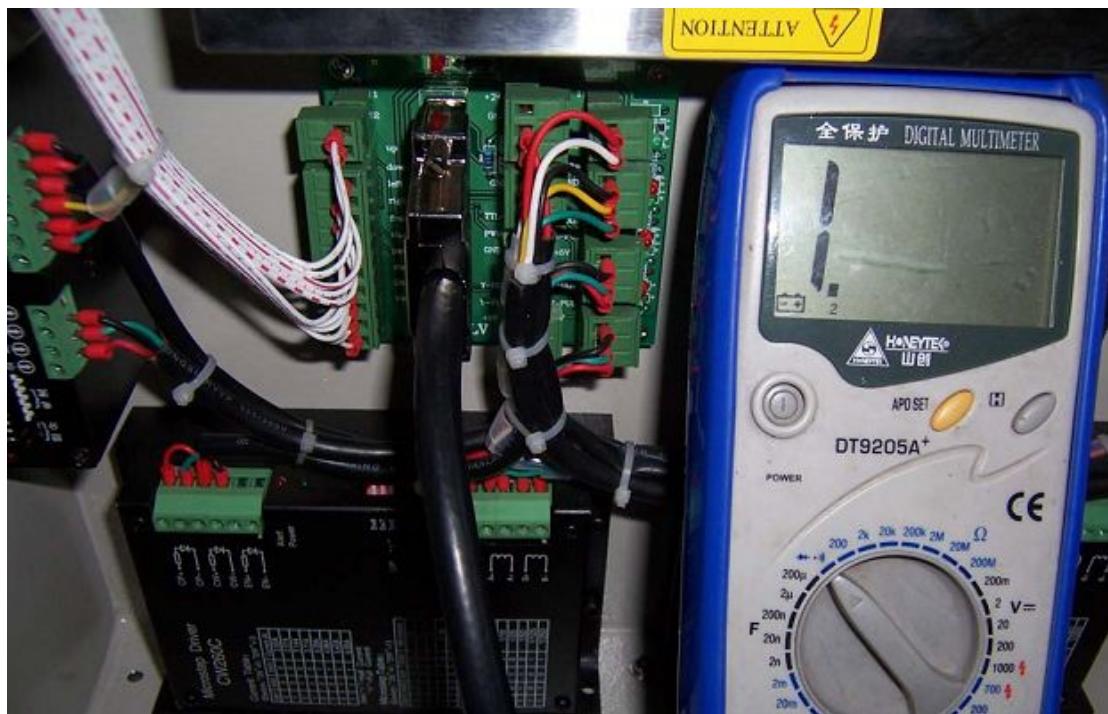
2. The CW signal of X axis controls the direction of X axis motor. When it goes leftwards, the lamp is on, and when it goes rightwards, the lamp is off.

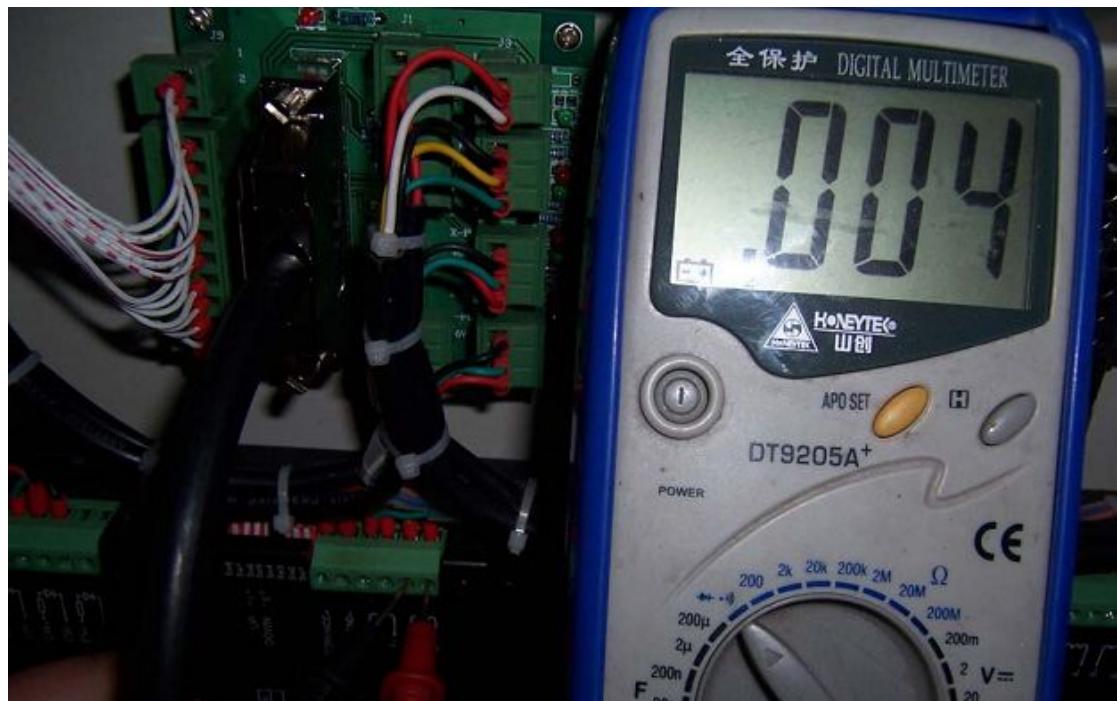
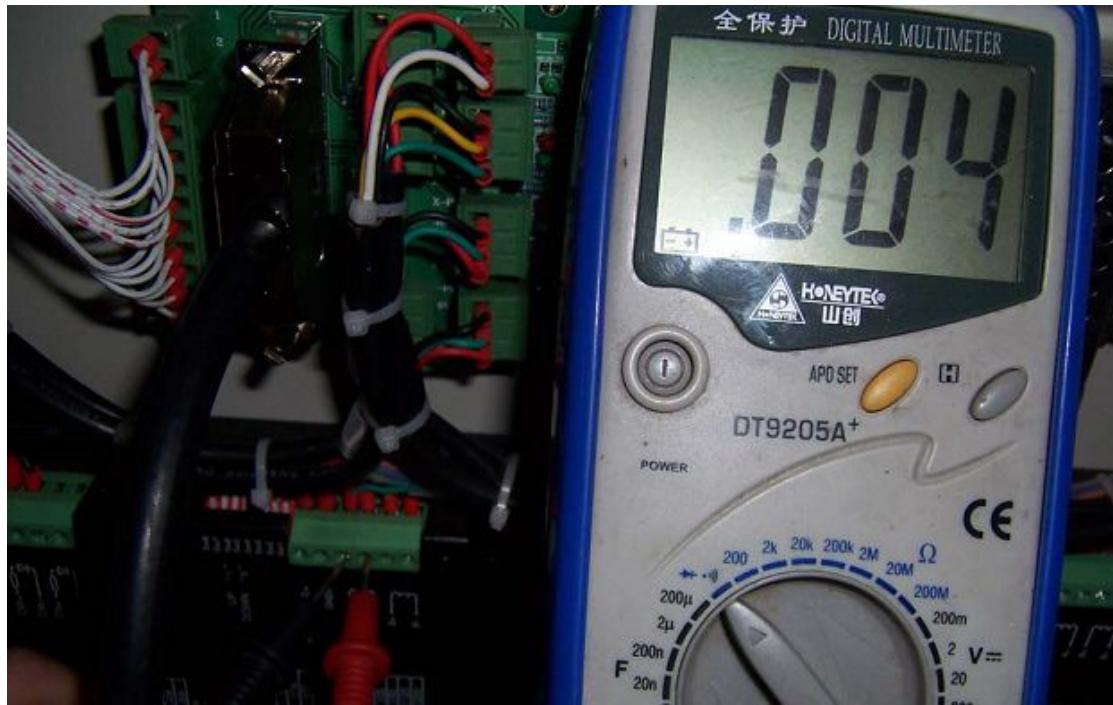
3. The CP signal of X axis controls the distance of X axis motor .When it goes leftwards, the lamp is on, and when it goes rightwards, the lamp is also on.
4. The CW signal of Y axis controls the direction of Y axis motor. When it goes downwards, the lamp is on, and when it goes upwards, the lamp is off
5. The CP signal of Y axis controls the distance of Y axis motor .When it goes downwards, the lamp is on, and when it goes upwards the lamp is also on
6. The CW signal of Z axis controls the direction of Z axis motor. When it goes downwards, the lamp is on, and when it goes upwards, the lamp is off

7 The CP signal of Z axis controls the distance of Z axis motor .When it goes downwards ,the lamp is on, and when it goes upwards , the lamp is also on

7.1 X axis motor doesn't run

Move X axis with the button, and observe the change of the lamp; if it is normal, then there is something wrong with the motor and drive. If it is not normal, then there is something wrong with the data wire and PCI card. Detection of the motor: Use the millimeter to check the A+ A-and B+ B-of X diver, find out whether the two group of coils is on state.



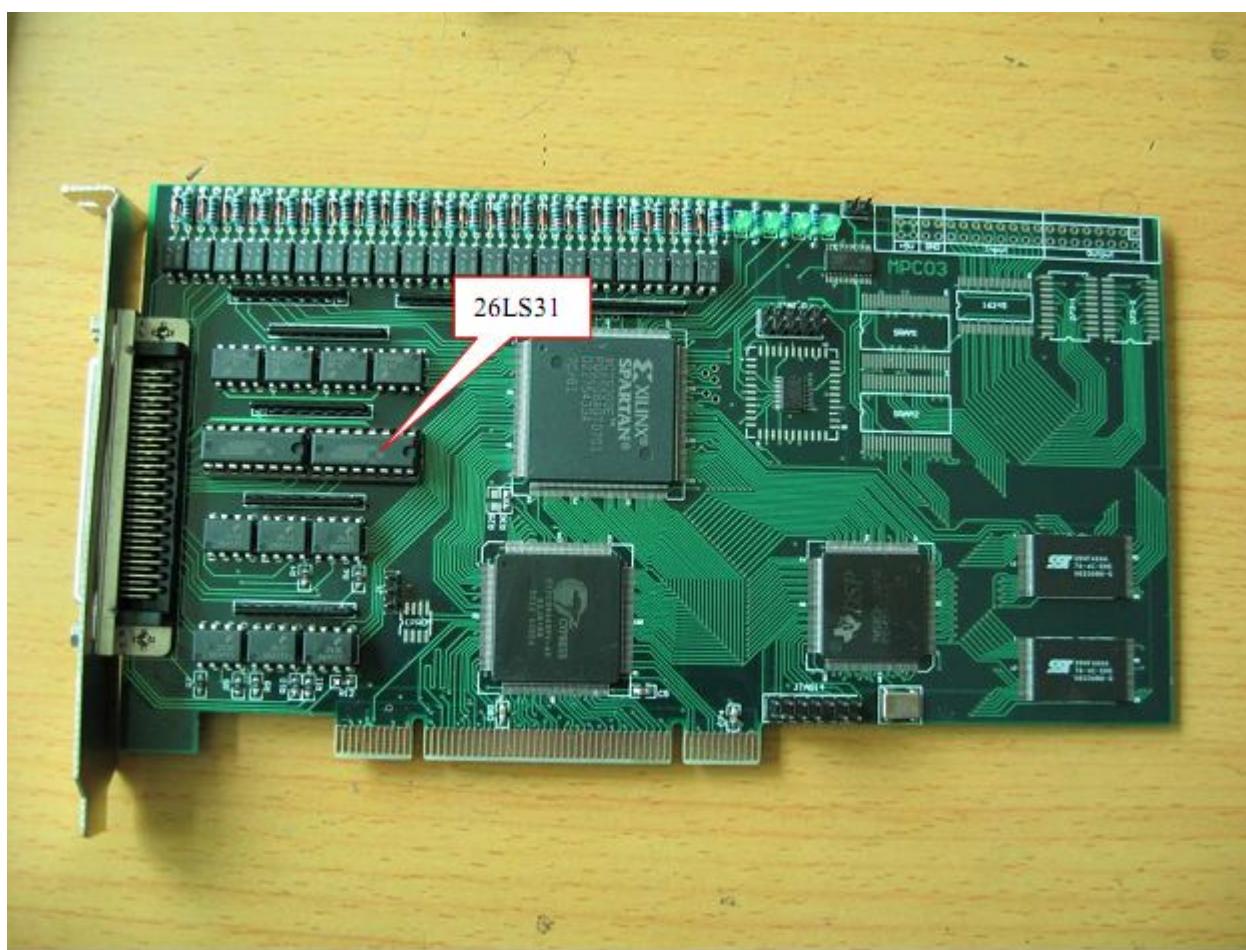


If it is on state, then there is no problem about the motor, otherwise there is something wrong with the wire from the drive to the motor. Detection of the PCI card and data wire



Check if the lines of the two sides are bending.

Change the 26LS31 of PCI card.



26LS31

Y axis motor doesn't run

Move the Y axis forward and back with the button, then observe the change of the lamp. If it is normal, then there is something wrong with the motor and diver, otherwise there is something wrong with the data wire and PCI card.

Estimation of the malfunction, refer to X axis.

7.4 Malposition of the engraving

Poor grounding and disturbed by high voltage

Speed of lost motion is too high

7.5 No laser given out.

Engraving a rectangle mount to find out whether the lamp winks or not (The green lamp is on if no laser given out, it is off when laser given out)

A. Winking: there is something wrong with the power supply and the laser tube. Press "test" finding out whether the ammeter indicator moves Indicator moves without light: there are something wrong with the laser tube(the laser tube is broken customarily)

Indicator does not move: the power supply and laser tube may both are damaged. You should check it seriously.

Estimation of the power supply and laser tube



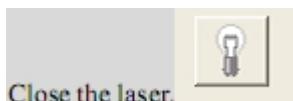
From left to right is 1,2,3,4,5,6 respectively

1-4 Control the transitions of the laser.

Give out the laser with high tension, and close it with low level.



Click the  button of the software to open the laser.



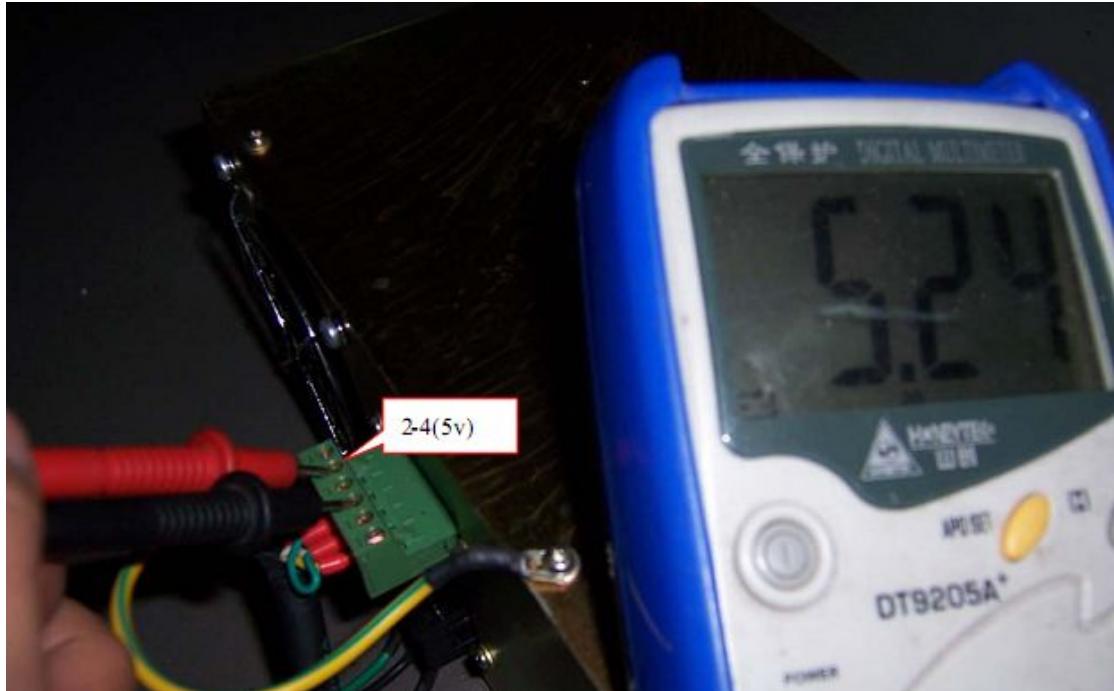


2-4: Controlling the transition of the laser manually, you can press the “TEST” button on the operation panel. When it can give out the laser (light)



2-4(0v)

When it can not give out the laser(light)



2-4(5v)

2-4. connect with the protection switch, if 2-4 short circuit, then the laser can give out light, if it opens Circuit, the laser can not give out light.

5: PWM signal controls the power of laser

You can estimate the problem of the power supply and laser with the naked eye, for example you can find out the fan of the laser power supply doesn't go round and round, and there is crack in the laser. If you can't judge the problem, please use the methods as follows



Press TEST the current meter will display as follows in normal condition/

Otherwise, the laser tube goes wrong.

Attention: you should cover a insulating board on the surface when testing, the parameter of wire-wound resistor is 100W 20KΩ

B.No winking: there is something wrong with the data wire and PCI card.



Do not get rid of malfunction by changing the datawire, then change 26LS31 (pay attention to the direction)

7.5 Low laser power

- A: The laser tube should be changed
- B: The optical path is askew
- C: The reflecting lens is dirt
- D: The focus lens is dirty

7.6 X..Y without movement

- A: 36V power without output 36V
- B: 5V power without output 5V
- C: poor datawire contact ion
- D: PCI card is damaged

8. Debugging of the engraving accuracy

After changing the laser, the accuracy may be not good, and then you can adjust it with the software.

You can change the engraving accuracy by amending the value of Acc space, it is from -0.3 to 0.3. The Parameter has been set up when the machine leaves factory, so it is suggested that you do not amend it.



9. Setup the main parameters of the software

Options

Any change of the parameters in “Options” will change the performance of the machine. Before Changing the parameter, you should consult the supplier.

9.1 Main interface

1 Information about manufacturer

It shows the basic information about the manufacturer and can't be modified.

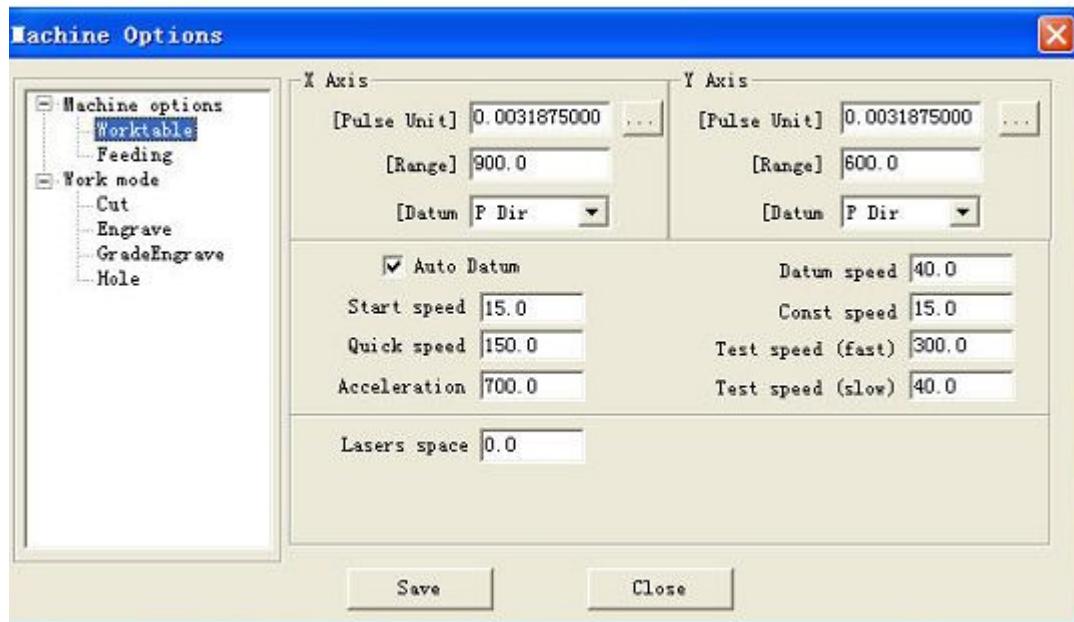
2. Other options

Use advanced options: There are advanced button as in “Laser output”. Some accessorial parameters will help you get better effect. But it will make the software more complex. Cancel this option, and you can't inter the interface of “advanced options”.

With Feed components: This is for feeding axis. If the machine has not feeding axis, this option should be canceled.

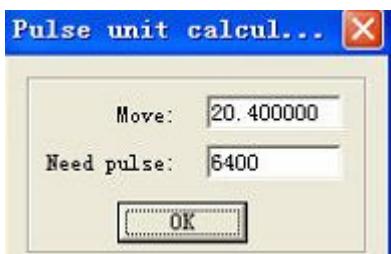
Auto Datum: If you input a number in it, the machine will datum when the run time reaches the number. It can eliminate the cumulate error of the mechanism.

9.2 Worktable



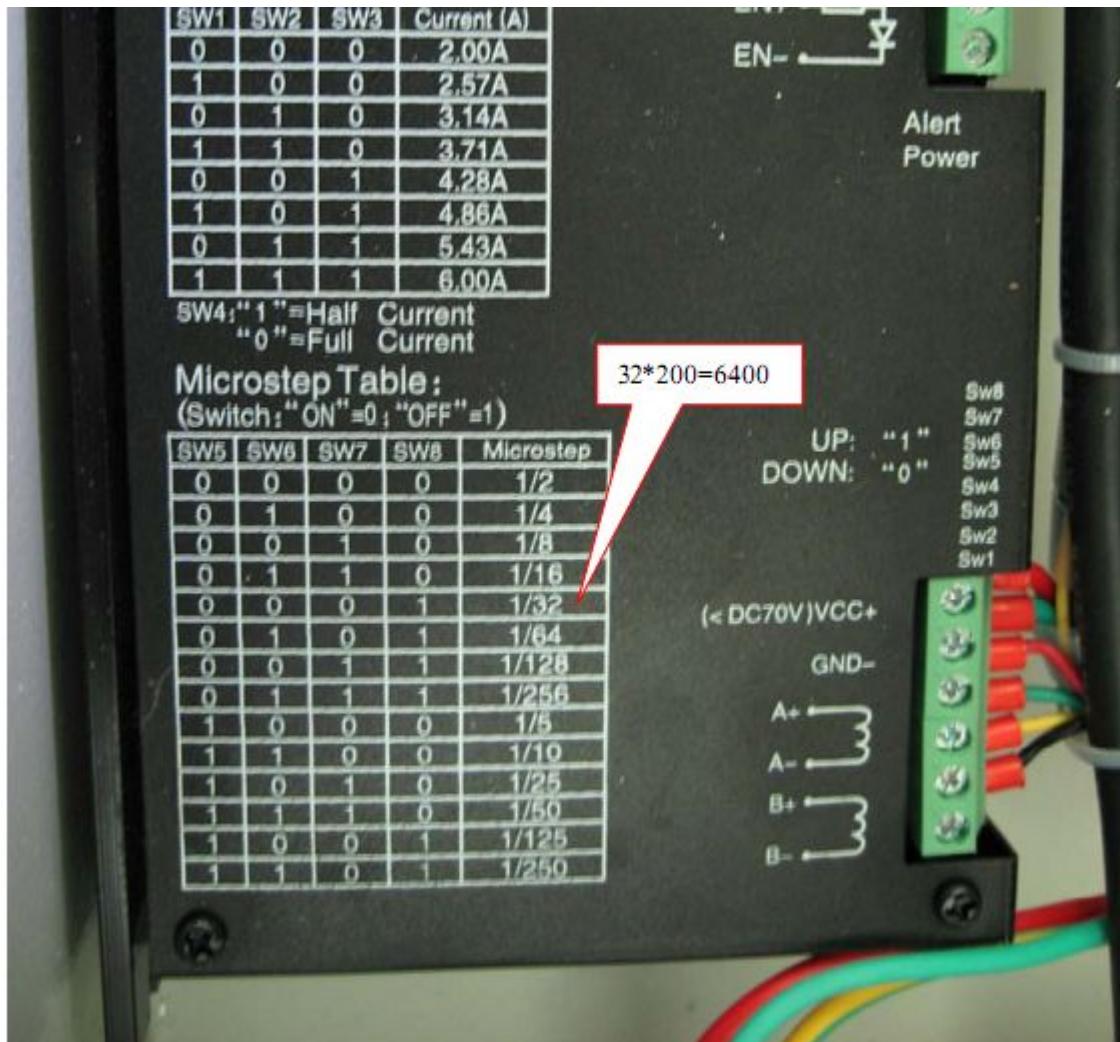
1 Pulse unit

It means the distance that the laser head moves when the control system output a pulse. If you don't know this numerical value, please click



Move: When the stepping motor moves a circuit, the laser head will move a relative length. You need to input the number in it.

Need use: The number is "driver's subdivision number" × 200.



Remember the coordinates of laser head. So you can move the laser head very quickly without worrying that it will overstep the worktable. If this function is canceled, you can only move the laser head slowly (the speed is “slow speed” and you can change it the “machine parameter setting” dialog box). And when you move the laser head, you have to be very careful to avoid striking the machine.

2. Datum Speed

It determines the speed of datum.

3. Start Speed

It is the start speed of all axes. Normally, the number should be chosen from 5-30mm/s according to different machines. If the number set up is too high, machine will shake intensively.

4. Const Speed

When cutting, if the (processing) speed is higher than even speed, the laser head will slow down on corners of the graphics. If the (processing) speed is lower than even speed, the laser head will not change speed during processing.

5. Quick Speed

This is the maximum speed of laser head moving without lasers emitting. When move the laser head up, down, left and right, this parameter will work. If the number is too high, machine will shake intensively.

6. Acceleration

It is the acceleration from start speed to quick speed.

7. Test Speed (fast)

This is the speed that you move the laser head when you select auto datum.

8. Test Speed (slow)

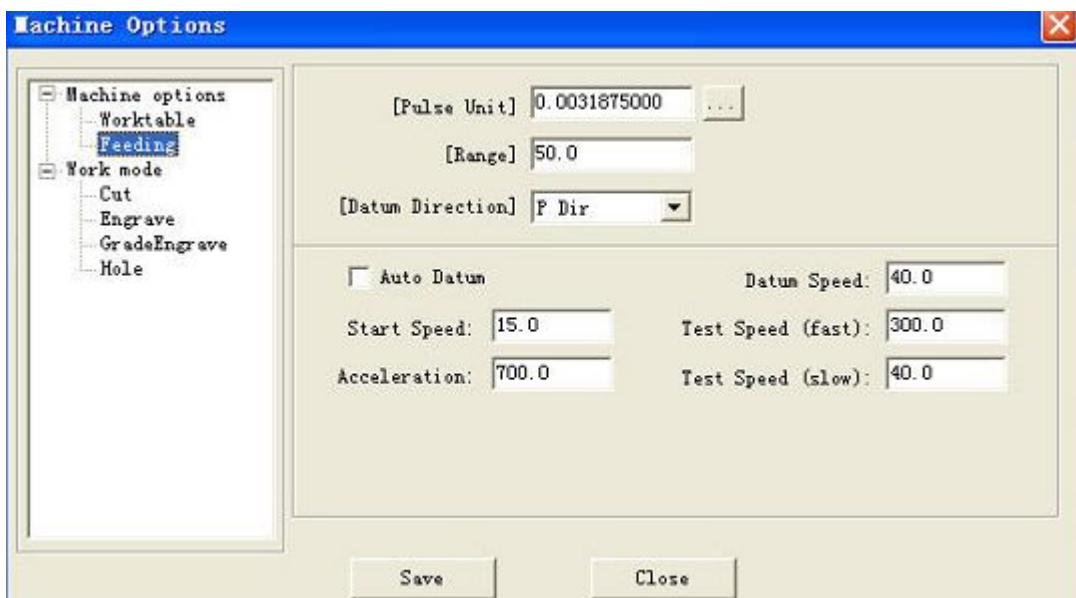
This is the speed that you move the laser head when you don't select auto datum.

9. Laser space

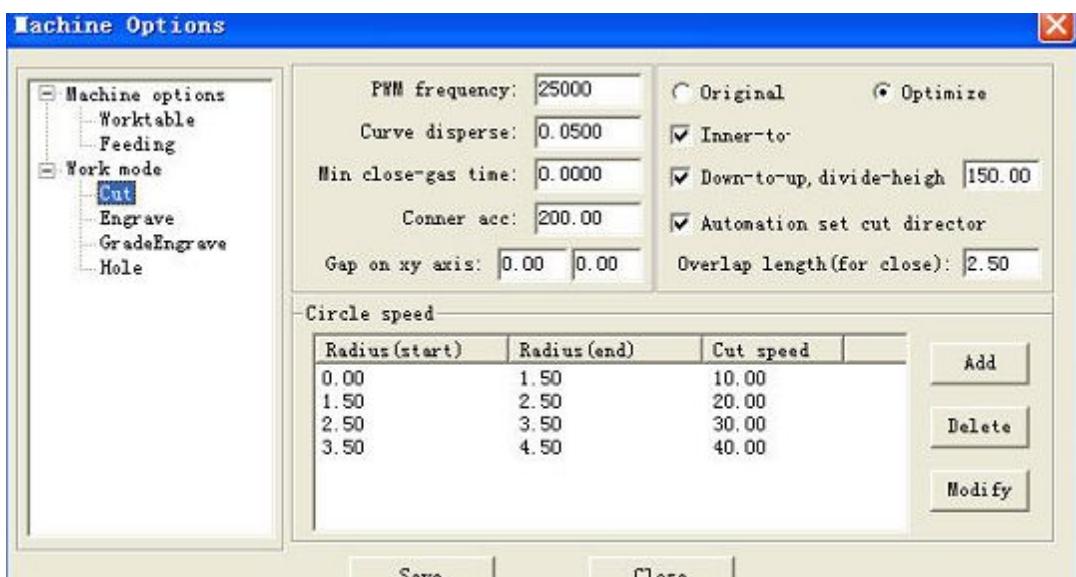
If there are 2 laser heads, the space of the laser heads should be input.

10. Feeding

The feeding axis can be used as feeding and lift working table.



Cut



It determines the precision of graph data. If the number is smaller, the precision will be higher and cost more time to calculate processing data.

9.4. Min close-gas time

1. When the time between the former blowing off and the next blowing on is less than the number, the machine will not blow off to protect the blowing switch.

It determines the processing precise when the processing route turns the corner. When the machine can't draw lines smoothly, please input a smaller number in "Acceleration" and "Corner Acc".

2. Gap on xy axis XY 轴的差异

Compensation gap when the motor changes direction. This parameter only works when cut with even speed.

3. Original

The machine draws the graph according the route as it is been made.

4. Optimize

The software will calculate the route to improve processing efficiency. If you select this option, there are 2 options.

In-Out: cut from inner to outer.

Down-Up: cut from down to up according the number of “divide-height”.

3. Automation set cut direction

The software will confirm the direction automatically. If you need to change the direction, please cancel this function.

Compensation

4. Overlap length

Because of the mechanical gap, circle can't be cut round. Input a certain number in it, and you can get the circle more round. But this will increase the processing time.

5. Circle speed

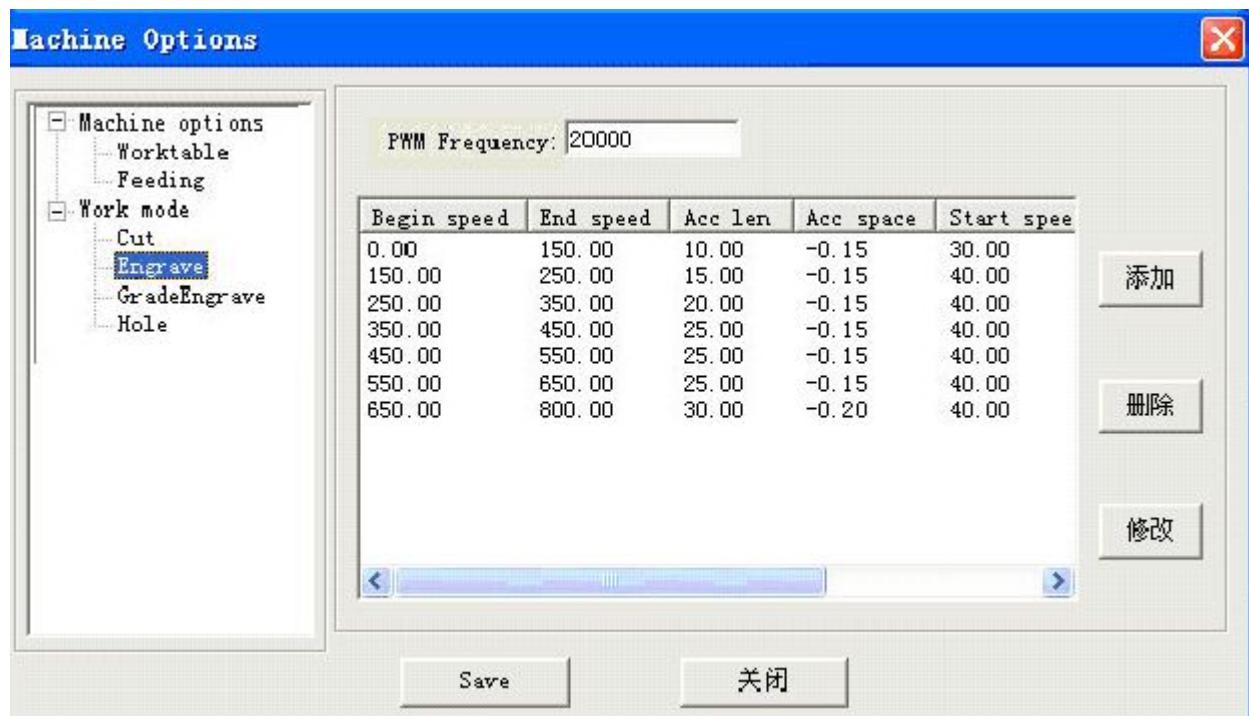
When cutting small circle (the diameter is especially between 1to 3) with high speed, it will be distorted. The parameters of “Set circle speed” are used to reduce distortion.

Double-click ether row of the list.



When the radius of circle is in the range between “Min radius” and “Max radius”, the cut speed will automatically be changed to the number of “Cut speed”.

9.5 Engrave

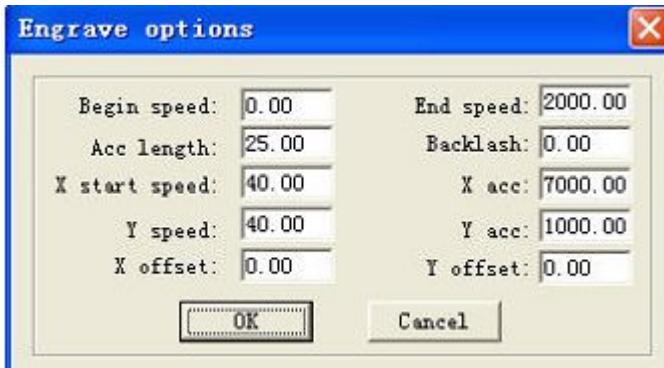


1 PWM Frequency

It determines the frequency of PWM signal.

2. Engrave options

Double-click ether row of the list.



Begin Speed and End Speed: When the engrave speed is set in the range between Begin Speed and End Speed, the system will automatically apply the numbers of Acc Length, Backlash...

Acc length: It is the engraving length without laser emitting. It determines the distance that the X-axis moves from start speed to (working) speed. If it is not long enough, the machine will shake intensively.

Backlash: It is used for compensating mechanical gaps. If the engraving edge is not orderly, please set up number in "Backlash". This number can be positive or negative.

Backlash X start speed: It is the start speed of X-axis when engraving. **X acc:** It is the acceleration of X-axis from start speed to (working) speed. **Y speed:** It is the speed of Y-axis when engraving **Y acc:** It is the acceleration of Y-axis from start speed to "Y Speed". If you find graphics error happens (that is motor lost step) you can set up a bigger number in

"Accelerator Length" or a smaller number in "Acceleration".

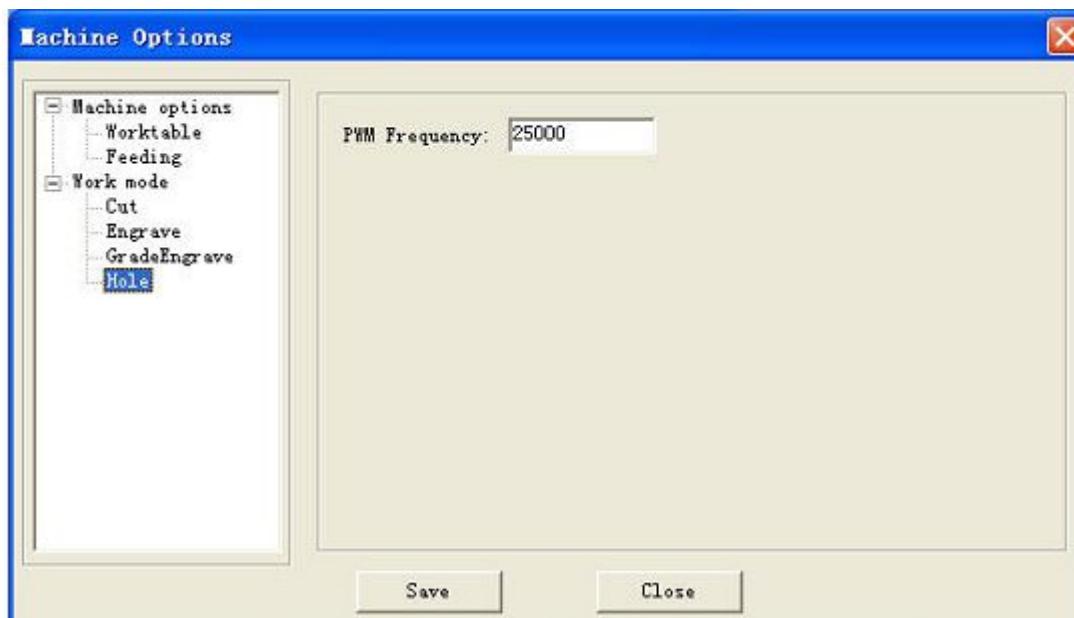
X offset: when engraving graph is not be the actual position. There is an offset. Input the offset is OK.

Y offset: when engraving graph is not be the actual position. There is an offset. Input the offset is OK.

9.6 Grade Engrave

Please refer to 6.5

9.7 Hole



1 PWM Frequency

It determines the frequency of PWM signal.

the machine load &upload by forklift not by person